CompactFlash Roundup ■ Intel 875P (Canterwood) & VIA KT400A Chipsets

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Q&A With Andy Paul

A Memorable Conversation With the CEO of Corsair Memory (page 108)

PINNACLE SYSTEMS Instant CD/DVD Creator Reviewed (page 73)

* Powering Your System (page 52)

* PCI EXPRESS™ Promises Speedier Buses (page 37)

* GDDR3: Graphics Memory Arrives (page 34)

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June 2003 • Vol 3 Issue 6

Spotlight

42 **Performance & Panache**
An Introduction To PC Modding

46 **Making A Case For Cases**
Lights & Aluminum Say It With Style

52 **Don't Blow It**
Install The PSU That's Right For You

56 **Be Cool & Quiet Down**
Advice For Keeping Your Rig Silently Chilled

60 **Performance & Overclocking Mods**
Fine-Tune Your Rig For Maximum Velocity

66 **An Eye On Aesthetics**
There's Still Hope For Your Humdrum PC

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Frontside

6 What's Happening
12 Digital Economy
13 **The Saint**
Nerd Experiments

The Experts

Joan Wood
Forward Slash
page 89

Lisa Lopuck
Site Scene
page 86

Chris Pirillo
Dialogue Box
page 74

Kyle Bennett
[H]ard Talk
page 31

Alex St. John
The Saint
page 13

Anand Lal Shimpi
Anand's Corner
page 29

Mike Magee
Shavings From The Rumour Mill
page 101

Alex "Sharky" Ross
The Shark Tank
page 30

Rob "CmdrTaco" Malda
The Department Of Stuff
page 88

Pete Loshin
Open Sauce
page 75

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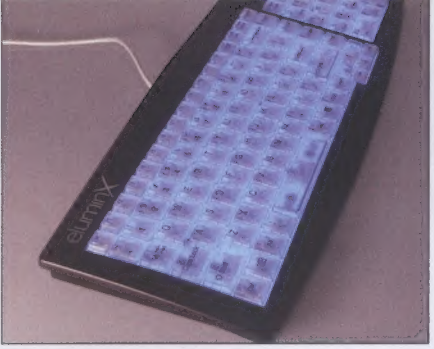


Heavy Gear

16 **Extreme Hardware**
These Gizmos Don't Sing It, They Bring It

17 **CompactFlash Crazy**
We Poke, Prod & Push 26 Cards In Our Tests

20 VIA KT400A
PRISMIQ MediaPlayer

21 Intel 875P (Canterwood)

22 Fujitsu MAS3735NP SCSI 73GB
Samsung SW-252B CD-RW 52X/24X/52X

24 NVIDIA nForce3 Professional
NVIDIA GeForce FX Go

25 Apple iMac 17-inch SuperDrive

26 M-Audio Revolution 7.1
Palm Tungsten T

27 Auravision EluminX Illuminated Keyboard
Canon i950 Photo Printer

28 IBM ThinkPad T40 1.6GHz

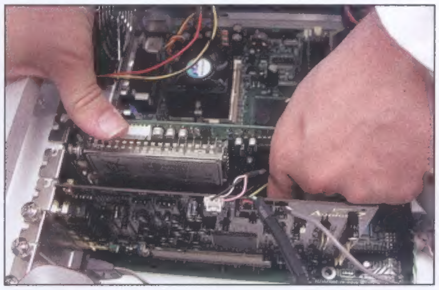
29 **Anand's Corner**
Coming Intel & ATI Upgrades

30 **The Shark Tank**
A Few Gaming Upgrades

31 **[H]ard Talk**
ABIT & Intel @ 1GHz

Hard Hat Area

32 **Swappin' Parts**
CINDI's Black Screen Of Death



34 **X-ray Vision:** The Memory Standard Geared Toward Graphics

37 **White Paper:** PCI Express
The Next Big Thing To Hit Your PC

Loading Zone

70 **The Bleeding Edge Of Software**
Inside The World Of Betas

72 **Up To Speed**
Upgrades That'll Keep You Humming Along

73 InterVideo WinDVD Creator Plus
Pinnacle Instant CD/DVD Creator

74 **Dialogue Box**
Software To Speed Up Your System—Maybe

75 **Open Sauce**
The Free Digital Darkroom

Caught In The Web

76 **Fringe:** Computing's Periphery

79 **Is There A There There?**
Can High-Concept & High-Tech Rekindle The Virtual Community Dream?

82 **Connected At 12,000 Meters**
Lufthansa's Airline-Internet Experiment

84 **Coder's Corner: XML**
XSLT Part VI: Booleans & XPath

86 **Site Scene**
Flash Meets QuickTime

88 **The Department Of Stuff**
ampthis.txt

89 **Forward Slash**
Embedded Bloggers

Digital Living

90 **Road Warrior**
Processors, Pork Barrels, BlackBerry On Pocket PC & More From The Mobile Front

92 **At Your Leisure**
Plug In, Sit Back & Fire Away

Tips & Tricks

96 **Software Tips & Projects**
Optimize Outlook

98 **Warm Up To Penguins**
Create & Edit Images With The GIMP, Part II

What's Cooking

101 **Shavings From The Rumour Mill**
Wi-Fi Hotspot Shortage Wants Fixing Fast

102 **Technically Speaking**
An Interview With Mark Thompson, Founder Of AnalogX

106 **Under Development**
A Peek At What's Brewing In The Laboratory

Back Door

108 Q&A With Andy Paul

Infinite Loops

Strange stats and other oddball items from computing's periphery

77, 80, 94, 99

GREETINGS FROM SAMITLAND

Welcome back. We're getting ready to enter the summer months, and I'm already heating up under the collar. There are those who love the heat, but my PCs generate enough warmth for a household of Choudhuris, so it's with great sadness that I watch the end of our cold months. But you're not here to listen to me whine, right? Good. We've got some good stuff that I think you'll like.

Our focus this month is modding, but we've thrown in a nice mix of base-level parts that any serious PC enthusiast is going to need (cases, power supplies, fans, and so forth). I share a bedroom with a PC (or two), and finding a way to quiet the damn things was a boon. I'm sure this will be helpful to many of you. We also take a good look at how to boost your PC's performance and, as a bonus, make it look cooler (no pun intended). I'm hoping you will find our cover story both informative and enjoyable.

And before I forget: I've noticed that a lot more of you are posting on the CPU Forums, and I'm also happy to say that your emails continue to flow into our Inbox unabated. Do know that we read all your feedback even if we can't always get back to you. That feedback you post online or send to us is compiled and often discussed quite intensely on our end, so thank you for keeping us on our toes and giving us those valuable suggestions. From time to time (actually more regularly than that), I'm sure some of you will recognize articles that are a direct result of requests I've seen in your feedback. Please keep it up—we're listening.

Samit G. Choudhuri, Publication Editor, *CPU*

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CORRECTIONS

Page 20/May 2003 issue: The Minuteman S 700 *does* have surge protection for an RJ-45 jack.

Page 46/May 2003 issue: The Alienware system has just one 3GHz Hyper-Threaded CPU. It also includes an ATI Radeon 9800 Pro

Gotcha. Here it is.

- **Dual Power System 2 (DPS2)**
  The innovative technology that provides 6 phase power circuit for more stability
- **Dual Logical Processors**
  (Intel® Hyper-Threading Technology)
  Doubles system's computing power
- **Dual Channel DDR 400** Architecture
  Supporting high bandwidth up to 6.4GB/s to ensure greatest memory performance
- **Dual RAID** (SATA RAID + ATA133 IDE RAID)
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- **DualBIOS™**
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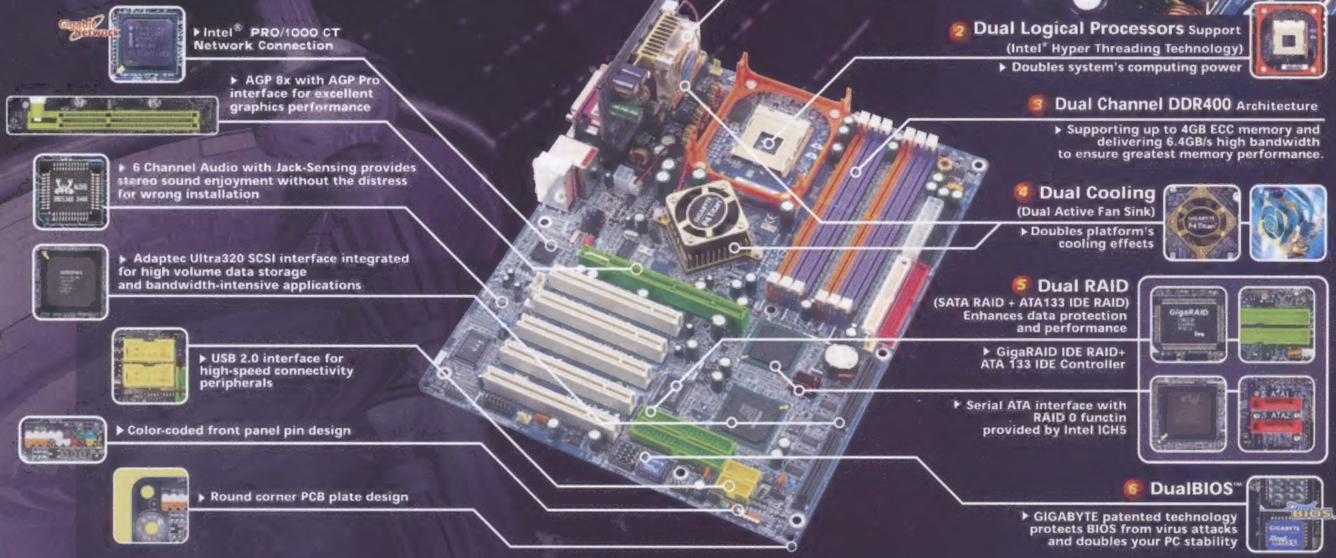

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- Adaptec Ultra320 SCSI interface integrated for high volume data storage and bandwidth-intensive applications
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- Color-coded front panel pin design
- Round corner PCB plate design

1. **Dual Power System 2 (DPS2)**
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LCDs Now On Top

Flat-panel displays, such as this 18-inch unit from Sony, will finally surpass CRTs in revenue this year, according to IDC.

A new report from IDC projects that revenues from LCD monitor sales will top $20 billion in 2003, at last placing flat panels squarely ahead of CRT sales.

One reason for the shift, predictably enough, is the falling price of LCD as the technology matures and more manufacturing plants come online. But another factor is CRT vendors' propensity to not educate the public about the benefits of CRTs over LCDs. In particular, most LCDs have a slow enough screen refresh rate that fast motion scenes appear to "ghost," although newer, high-end TFT models feature more-than-adequate pixel response rates.

Moreover, IDC estimates that the monitor market will grow by 4.3% this year as opposed to a mere 0.7% in 2002, thanks to improving economies and an expected rush in PC sales. Didn't experts say this last year, too? ▲

Soltek Hits 1,200MHz FSB

The proof is in the pixels. Soltek is advertising its new SL-85SPE family of motherboards as being 1,200MHz-capable when overclocked.

Undeterred by Intel's delay, Soltek has claimed the FSB overclocking crown du jour with its new SL-85SPE family of mainboards. Also available in models with integrated graphics, the boards use Intel's 865PE (GE) + ICH5 Springdale chipset, which is primarily significant for bringing Hyper-Threading support into the consumer mainstream.

Soltek's board features dual-channel DDR400 support, AGP 8X, Serial ATA, eight USB 2.0 ports, and, of course, an FSB with 400/533/800MHz compatibility. However, in a fit of overclocking frenzy, Soltek is advertising its new boards with the "world's highest" FSB: 1,200MHz. Next month, *CPU* will be back with a look at this claim to see if Soltek is actually stable at this lofty height. ▲

TiVo Meets The LAN

With the new Home Media Option, you can now network your TiVo Series2 PVRs so that one unit can play back recordings through any other Series2 in the house.

You know that a TiVo set-top box lets service subscribers schedule and record TV programs to a built-in hard drive. Now, TiVo's Home Media Option lets users share not only recorded shows, but also digital music and photos between TiVo Series2 DVRs linked across a home network. The Option entails a one-time $99 charge for two Series2 DVRs and $49 for each additional unit. The appeal is that now subscribers can record a show in one room and watch it in another. The new design stops short of letting users share recordings with PCs on the network, which in turn can relay the shows across the Internet. ReplayTV made this mistake, which is why the broadcasting industry sued the daylights out of the company, contributing to parent company SONICblue's bankruptcy. ▲

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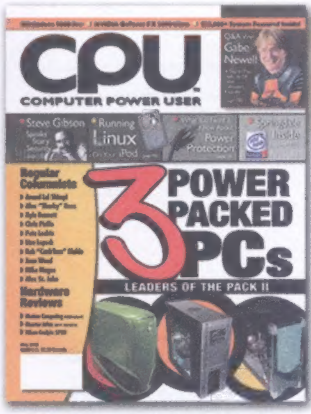

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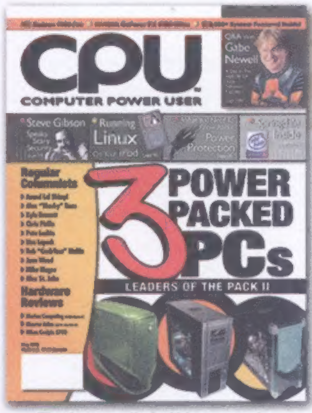

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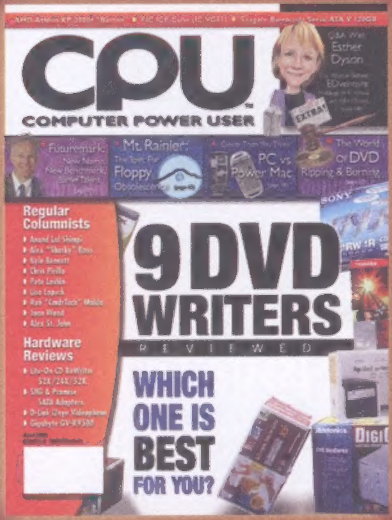

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Ultimately, there was only a tiny delay for the tiny chip. After halting the release of its new 800MHz FSB Pentium 4 because of a stray bug, Intel devised a software fix and sent the new processor off to system builders.

New P4:
Shipment Goes Down, Shipment Goes Up

Set to coincide with the release of its new Canterwood and Springdale chipsets, Intel was all set to send its first batch of 800MHz FSB Pentium 4 processors out the door. However, late-stage testing turned up a glitch, and Intel put on the brakes.

Intel stayed mum on the nature of the problem, so critics and troublemongers read into Intel's silence that it might be something substantial, maybe even worse than the 1994 Pentium floating-point error that proved to be one of the greatest public relations gaffes in Intel's history.

"Due to recent analysis," Intel spokesperson George Alfs told us on Friday, April 18, "and given our commitment to quality, Intel has placed the Pentium 4 processor at 3GHz with an 800MHz bus on ship hold temporarily. In the course of our final testing in our validation lab environment, we observed an anomaly on a very small number of these 800MHz bus processors. We are working to understand and resolve the issue, and we hope to ship this new processor as soon as possible."

Industry analysts were cautious when speculating how long the delay might last, but some guesses ran up to three months.

On Monday, April 21, though, right before CPU went to press, Intel resumed shipping of the new Pentium 4. No mention was made of the specific problem or how many chips were affected, only that the bug manifested under extreme lab conditions and would not occur in everyday use. Furthermore, Intel now has a software patch shipping to system builders that will remedy the problem. ▲

Hardware Mole

Our endearingly myopic hardware mole always has one ear to the ground. Here's his scuttlebutt at press time.

WiMAX Works to Deliver New 802.16 Products

Intel, Nokia, Fujitsu, and several other companies banded together in early April to create a new nonprofit company called WiMAX (World Interoperability for Microwave Access). Essentially, WiMAX (www.wimaxforum.org) will seek to mirror the achievements the Wi-Fi Alliance (www.wi-fi.org) made. The difference is that while the Wi-Fi Alliance worked to popularize and certify products based on the 802.11 spec, WiMAX will work to advance 802.16. The newer protocol is a microwave-based networking technology that can achieve speeds up to 70Mbps without line-of-sight restrictions. Even better, 802.16 works across a distance as far as 31 miles, making it a leading broadband contender for rural areas. ▲

AMD has increased its stake in a flash memory partnership with Fujitsu. Many speculate that AMD will spin its flash memory business off into a new company fairly soon.

AMD Prepping A Spin-Off?

The industry buzz just prior to press time was that AMD would soon increase its stake in a partnership with memory manufacturing partner Fujitsu, resulting in the formation of a new company called Fujitsu-AMD Semiconductor Ltd. This new entity would encompass the flash memory operations from both parents. Given that most of AMD's flash memory team is based in California, while the processor crew is in Texas, some analysts speculate that the new memory company will soon be spun off from AMD, a move that may have contributed to the roughly 60% rise in AMD's share price from $5 in early February. ▲

More Broadband: Is Current The Future?

If you're part of the 14% of U.S. households that presently have broadband access, chances are that you pay $40 to $60 per month for service. What if you only had to pay $30 per month and could pull in your Internet feed straight from the power grid? This is what equipment maker Current Technologies (www.currenttechnologies.com) hopes to achieve by the end of this year. By using the powerline wiring already running through every home, Current wants to enable not only high-speed data access but also voice-over-IP, video streaming, and simple home networking. Although the company is mum about download speeds, one source at www.wave-report.com, conveying a discussion with one Current vice president, notes speeds of at least 2Mbps, even when all lines from a transformer are in use. ▲

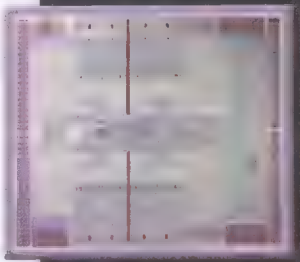
What's Happening · Chip Watch

Compiled by
Dean Takahashi

To continue the tradition established way back in July 2002, we bring you a page of the choicest chip news. Enjoy!

Sun Microsystems Opts For Chip Multithreading

When Sun Microsystems bought Afara Websystems last year, it settled a debate within the company over which way to take its microprocessor architecture in the future. Marc Tremblay, chief architect at Sun, said that the deal endorsed Afara's approach to computing: Put lots of processors on a chip and make each one handle multiple threads. When one thread bogs down because of memory latency, or the increasingly long time it takes to fetch data from main memory, the processor can switch to the next thread while it waits for the data. Tremblay and Afara architect Les Kohn say Sun can put at least four processors on a chip by 2005 and that each one will be able to handle four threads, or separate concurrent programs. ▲



Sun says Afara chips (code-named Niagra) should be able to handle at least 16 threads by 2005.

Ubicom Launches Second-Generation Wireless Controller

Pretty soon, you'll be able to put a Webcam anywhere in your home and have it send images wirelessly to your PC at broadband speeds. Thank Ubicom, a maker of wireless controllers, for that technology. Ubicom has also turned to multithreading for its second-gen wireless network processor. CTO David Fotland says the company's new IP3023 chip will be able to process eight threads at once as it converts wireless radio signals into data packets that can be sent through a network. By processing so many threads at once, the company expects to make chip speeds four to 10 times faster. Production for the IP3023 is slated for the second half of 2003; the processor will sell for $12 in 100,000 unit quantities. ▲

QuickSilver's Reconfigurable Hardware Makes A Comeback

Reconfigurable chips were the rage a couple of years ago. But as broadband nirvana crashed and third-generation wireless pushed out, some of the companies making these newfangled chips ran into tough times. One that held on was QuickSilver Technology, which recently cut a deal to license its technology to Olympus. QuickSilver's Adaptive Computing Machine is made of programmable elements so that it can quickly create hardware as needed. Change the software running through the machine, and it reconfigures the hardware to do something else. Because this hardware can perfectly suit the software at hand, it can run at speeds dozens of times faster than custom chips, says QuickSilver Chairman Gordon Campbell. Olympus might use the technology in a digital camera that could reconfigure itself to be another device, such as a video camera, through a simple software upgrade. ▲

Watching The Chips Fall

Here's a rundown of the latest AMD and Intel CPU pricing information compared with initial release pricing.

CPU	Released	Original Price	Current Price	Last Month's Price
AMD Athlon XP 1600 +	10/09/2001	$160	$48	$48
AMD Athlon XP 1700 +	10/09/2001	$190	$50	$53
AMD Athlon XP 1800 +	10/09/2001	$252	$59	$62
AMD Athlon XP 1900 +	11/05/2001	$269	$68	$69
AMD Athlon XP 2000 +	01/07/2002	$339	$76	$77
AMD Athlon XP 2100 +	03/13/2002	$420	$82	$89
AMD Athlon XP 2200 +	06/10/2002	$241	$90	$102
AMD Athlon XP 2400 +	08/21/2002	$193	**$111	$130
AMD Athlon XP 2600 +	08/21/2002	$297	**$189	$221
AMD Athlon XP 2700 + 333MHz FSB	11/14/2002	$349	**$250	$262
AMD Athlon XP 2800 + 333MHz FSB	11/14/2002	$397	**$336	368
AMD Athlon XP 3000 + 333MHz FSB	02/10/2003	$634	*$548	$590
Intel Pentium 4 1.5GHz	11/20/2000	$819	$111	$111
Intel Pentium 4 1.6GHz	04/23/2001	$294	$119	$125
Intel Pentium 4 1.7GHz	04/23/2001	$352	$125	$124
Intel Pentium 4 1.8GHz	07/02/2001	$562	$128	*$130
Intel Pentium 4 1.9GHz	08/27/2001	$375	$145	$145
Intel Pentium 4 2GHz	08/27/2001	$562	$161	$155
Intel Pentium 4 2.2GHz	01/07/2002	$562	$175	$175
Intel Pentium 4. 2.4GHz 400MHz FSB0	4/02/2002	$562	$160	$174
Intel Pentium 4 2.5GHz 400MHz FSB	08/26/2002	$243	**$185	$211
Intel Pentium 4 2.6GHz 400MHz FSB	08/26/2002	$401	**$227	*$233
*Intel Pentium 4 2.26GHz 533MHz FSB	05/06/2002	$423	$166	*$168
Intel Pentium 4 2.4GHz 533MHz FSB	05/06/2002	$562	$157	$162
*Intel Pentium 4 2.53GHz 533MHz FSB	05/06/2002	$637	$185	$211
Intel Pentium 4 2.66GHz 533MHz FSB	08/26/2002	$401	**$227	*$233
*Intel Pentium 4 2.8GHz 533MHz FSB	08/26/2002	$508	**$399	$399
Intel Pentium 4 3.06GHz 533MHz FSB	11/14/2002	$658	*$510	$564

* Retail price ** Manufacturer's price per 1,000 units.
Other current prices, if indicated, are lowest OEM prices available through Pricegrabber.com

Developers can now view, tweak, improve, and market their enhancements to Windows CE, including the Pocket PC platform, thanks to a new licensing deal from Microsoft.

Microsoft Opens Windows CE

Getting Microsoft to pry open its doors and instigate a shared-source program for Windows CE developers was no small task. But the new Windows CE Shared Source Premium Licensing Program, which lets developers finally commercialize the custom work they do in the operating system's source code, is progressive Redmond thinking at its finest.

Until now, developers only had access to just under half (about 400,000 lines) of Windows CE's source code for viewing, debugging, and modifying. The key restriction was that they could not sell any changes made to the code. Now, developers not only receive full access to the entire OS code base, but they can also market the fruits of their labors.

The licensing change comes at an interesting time, given that the PDA market seems to have slowed and Palm has been able to work on reinforcing its product line.

"Having access to the Windows CE Shared Source Premium code base sparks additional innovation," said CTO Craig Mundie during an in-house Microsoft interview. "Additionally, silicon vendors can more rapidly optimize their processors for faster and more seamless performance with the Windows CE operating system, and system integrators can help their customers build hardware and software solutions for Windows CE that bring products to market faster and at a lower cost." ▲

Software Shorts

IBM Promotes Autonomic Blueprint

One of the world's biggest advocates of grid computing and infrastructures for sharing resources across wide-flung networks, IBM recently published a free document that provides a "blueprint" on how companies can construct autonomic computing systems, meaning systems and networks that are self-diagnosing and self-healing.

"Autonomic computing capabilities will emerge from innovative hardware and software from a number of sources," said Alan Ganek, vice president, IBM Autonomic Computing, in a company statement. "With this blueprint, IBM is suggesting a set of technical guidelines to help ensure that those piece-parts are designed from the start to work together effectively, regardless of their source. The best way to achieve this is through the use of specifications that are open and unencumbered."

By no small coincidence, IBM accompanied its blueprint release with the unveiling of several software tools designed to facilitate autonomic computing systems. Autonomic systems will theoretically reduce the burden typically placed on IT staff and end users. Ideally, the autonomic capabilities developed and deployed in enterprises will someday filter down into the mainstream so that PCs and OSes might actually avert crashes before they happen. Dream a little dream. ▲

Will Server 2003 Be .NOT?

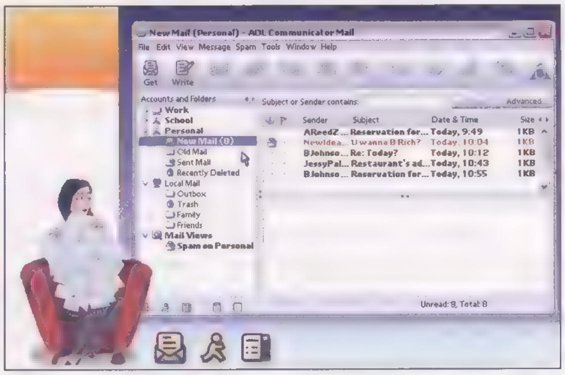
Microsoft's Windows Server 2003 entered production in late March, but an expected report from the Yankee Group shows that market adoption may fall well below Redmond's hopes. Whereas 30% of Microsoft's install base moved to Windows Server 2000 within a year of its release, less than 20% of the companies Yankee Group surveyed anticipate moving to .NET within the next year, and only 34% plan on buying it at all. Microsoft's biggest enemy appears to be itself, as over 40% of those who said they will not be buying felt there was no compelling reason to upgrade over current Windows platforms. Nine percent said they were switching over to Linux. Other inhibitors include the present economic climate and Microsoft's new licensing program. ▲

Got Some ID For That Game?

If you live in Washington, be sure to take your driver's license with you next time you buy a violent video game. The Washington House of Representatives signed off on a bill in March by a vote of 47 to 7 that would fine retail employees $500 for selling video games that depict the killing of police officers or violence against women to minors. The would-be law, now only waiting for Gov. Gary Locke's signature, is a response to "Mature"-rated games such as Grand Theft Auto: Vice City, in which players can blow up police cars, instigate prison riots, and bludgeon prostitutes to death. Critics accuse the measure of being censorship. ▲

AOL Previews Communicator

"So easy to use, no wonder it's a clone of Microsoft Outlook" might be the unofficial slogan for America Online's new instant messaging and email client, dubbed AOL Communicator. The program, still under development, integrates a fortified version of AIM (AOL Instant Messenger) along with an email client that looks and acts much like Microsoft's Outlook. This way, users don't need to keep two apps open to manage their text messaging needs. AOL Communicator—not to be confused with the Netscape Communicator browser and email client package, which AOL also owns—will also handle mail from any POP or IMAP server, meaning that users can juggle all of their messages from inside and outside AOL under one interface. The title also includes an identity manager for encrypting email and instant messages, which should help pull in advanced users and some businesses. AOL has not announced when Communicator will be finalized or whether it will be a free offering to its currently receding customer base. ▲



Sender	Subject	Date & Time	Size
AReedZ ...	Reservation for...	Today, 9:49	1KB
NewIdea...	U wanna B Rich?	Today, 10:04	1KB
BJohnso...	Re: Today?	Today, 10:12	1KB
JessyPal...	Restaurant's ad...	Today, 10:43	1KB
BJohnso...	Reservation for...	Today, 10:55	1KB

Unread: 8, Total: 8

The AOL Communicator combines elements of the AOL Instant Messenger and an email client.

California About-Faces On Internet Taxes

During the dot-com heyday, California Gov. Gray Davis was all about opposing online taxes, saying they would obstruct growth in the e-sector. Now, as pink slips blow through Silicon Valley like tumbleweeds and California is faced with a $35 billion budget deficit over the next 14 months, the $1.75 billion in lost annual sales tax revenue (more than any other state in the United States) to tax-free ecommerce is looking pretty tempting. Thirty-five states and the District of Columbia already hammered out a deal in February with major online vendors as part of the Streamlined Sales Tax Project, an effort to equalize taxes for Internet- and mail order-based companies. California did not participate in the project, but a tax committee within the state's Senate just approved two bills that would let California start collecting taxes on products out-of-state vendors sell. ▲

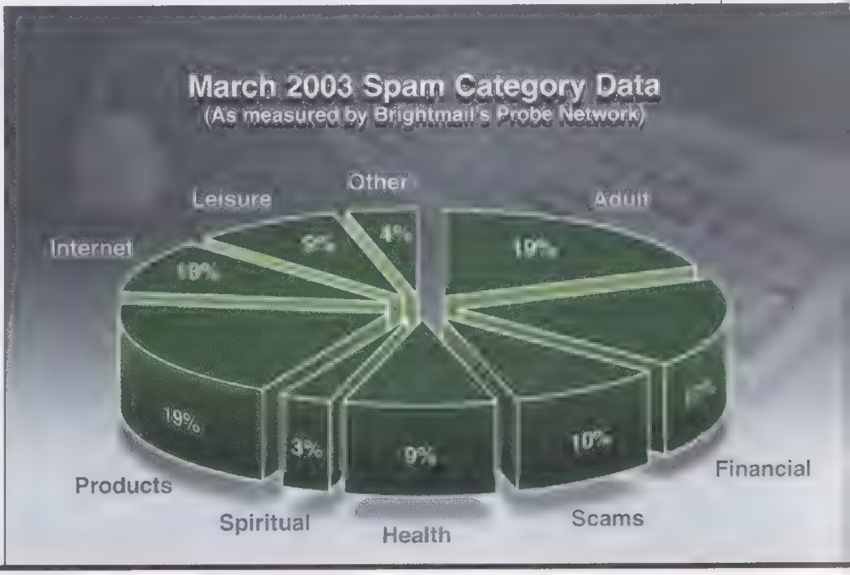
Show Your Support With Spam!

History shows that war is inevitably good for the economy. Apparently, spammers were hoping war would be good for them, too.

According to email filtering company Brightmail, total spam volume jumped by 4% in March, the single biggest month-to-month increase on record. Leading the spam charge was a new phalanx of messages aimed at selling war-themed and patriotic merchandise, such as American car flags, Defenders of Freedom U.S. coins, water filter systems in case of terrorist attack, and, best of all, Israeli gas masks. In January, Brightmail had yet to see a single gas mask spam. By late March, there were 216 variations of the unsolicited message.

Jupiter Research states that the average online American now receives more than 2,200 spam messages annually. A British government research study completed in March shows that 40% of global email traffic is spam. ▲

Ever wonder just how that flood of unsolicited junk breaks down by topic? Here's the official word from Brightmail.

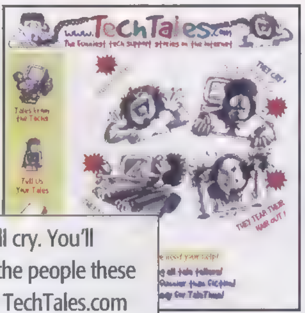


Loose Strands On The Web

Looking for some new surfing destinations? Here are a few sites you may have missed.

Comedy? Horror? Just Tech Tales

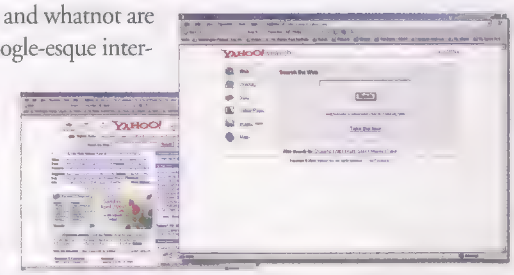
We all know the "Where's the Any key?" joke, as well as the one with the guy who thinks his CD-ROM is a cup holder and the lady who can't start her PC by pressing the foot pedal (meaning the mouse). But the supposedly true-life tales of geeks from across the Web at www.techtales.com give fresh meaning to the word "newbie" and the depths to which people will abuse technology when they don't think about it. ▲



You'll laugh. You'll cry. You'll swear you know the people these stories are about. TechTales.com brings you the best in newbie and IT manager ignorance.

New Yahoo! Design Worth Yodeling Over

You already know about Yahoo! searches. But you may not know about the slick search interface revamp that followed Yahoo!'s massive round of consumer research and testing. For starters, check out the spartan home page at www.search.yahoo.com. All the headlines, shopping promos, directory categories, and whatnot are gone, replaced by a stripped-down, Google-esque interface with tabs for results in Web hits, the Yahoo! Directory, News, Yellow Pages, Images, and Maps. Essentially, it's all the same Yahoo! content, only repackaged for much better clarity, convenience, and ease of access, thanks to a new tabbed interface in the search results and several other new enhancements. If you've ditched Yahoo! for some other search engine, give the old site another try. It's not the same place you remember. ▲



And You Thought Crop Circles Were Cool

Imagine taking a highlighter pen to a state road map and tracing an intricate route that might take days to follow. Now drop away the map, leaving only the highlighter tracing. What shape would it make? A wine glass? A cat? What if you purposefully created a route that would trace out the word WILD? Now you get the idea behind www.gpsdrawing.com, the Global Positioning System drawing project. Using a special Shockwave tool that interprets data from your GPS device, you can create seriously large-scale artwork for display in a tiny format on this site. Crazy stuff. ▲

Verizon Gives Up Swapper To RIAA

The 1998 DMCA (Digital Millennium Copyright Act) claimed another small victory at the cost of free speech and due process. At least that's the stance taken by Verizon, which finally lost its appeal case and was ordered in mid-April to comply with the Recording Industry Association of America's demands. At issue was the identity of a Verizon Internet service subscriber who allegedly downloaded more than 600 songs in a single day. The RIAA has issued at least 10 such DMCA subpoenas, but Verizon was the only provider to put up a fight. Verizon maintained its opposition that the DMCA violates basic constitutional rights and that it only pertains to pages stored on the company's own servers, not outside peer-to-peer file swapping networks. Apparently, the Justice Department failed to see it that way. Verizon has stated that one possible outcome of such rulings is that anyone purporting to be a copyright holder could obtain the private contact information of another Netizen and use this information for nefarious ends. ▲

BIOS Upgrades Available Online

COMPILED BY MARTY SEMS

Before you send another motherboard to the landfill, consider upgrading the BIOS and giving your PC a new outlook on life. Here are a few recently released upgrades. Subscribers can check out www.cpumag.com/cpujun03/bios to see our entire upgrade list.

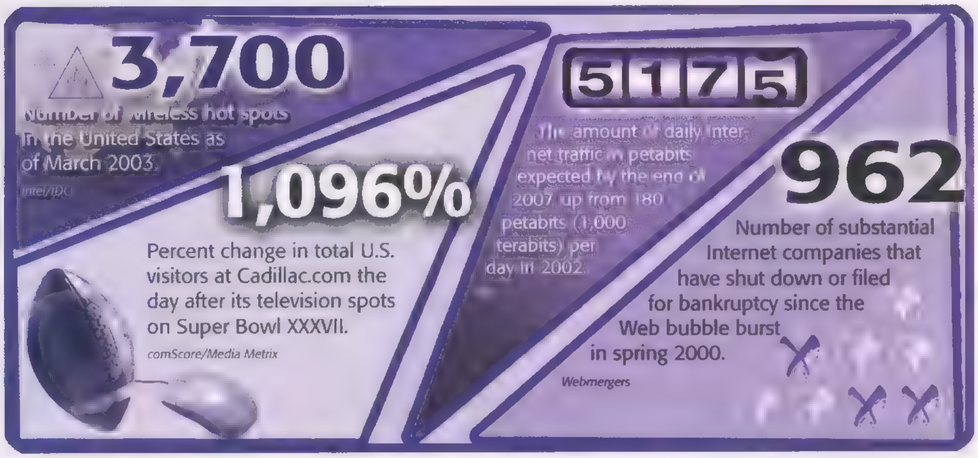
Motherboard	File (Date Available)	URL
AOpen AX4C Max	R1.02 (2003/04/10)	club.aopen.com.tw/downloads
Asus A7N8X/A7N8X Deluxe 2.0 and later	1003 (2003/04/08; read fine print)	www.asus.com/support/download/item.aspx?ModelName=A7N8X
ECS L4S5A/DX+ PCB 3.0x	1.0f (03/21/03)	www.ecsusa.com/downloads/l4s5a_dx_3x.html
Epox EP-4GEADI, EP-4PEAD, EP-4PEADI	3/14/2003	web.epox.com/html/support.asp?lang=1
Gigabyte GA-8GE800	F4 (2003/3/18)	www.giga-byte.com/Motherboard/Support/BIOS/BIOS_GA-8GE800.htm

Compiled by Steve Smith

IT In The Line Of Fire

Think there isn't much call for tech types in some of the world's geopolitical war zones? Guess again, Rambo geek. In Islamabad, Pakistan, which is just a grenade toss from Osama bin Laden's purported hiding spot, you can have a job as IT Manager at The Money Store. Some marketing and bulk mail experience is required. The British business services firm CLR Global needs a Webmaster in Qatar, the nation that is home to the Al-Jazeera TV network headquarters. And if you have about five years of network engineering experience and want to relocate "somewhere in the Middle East," AMED Software may have something just for you. You can find all these job postings and more at www.reach4iraq.com, part of the Reach4 network of Middle East job postings. ▲

RAW DATA



3,700
Number of wireless hot spots in the United States as of March 2003.
Intel/IDC

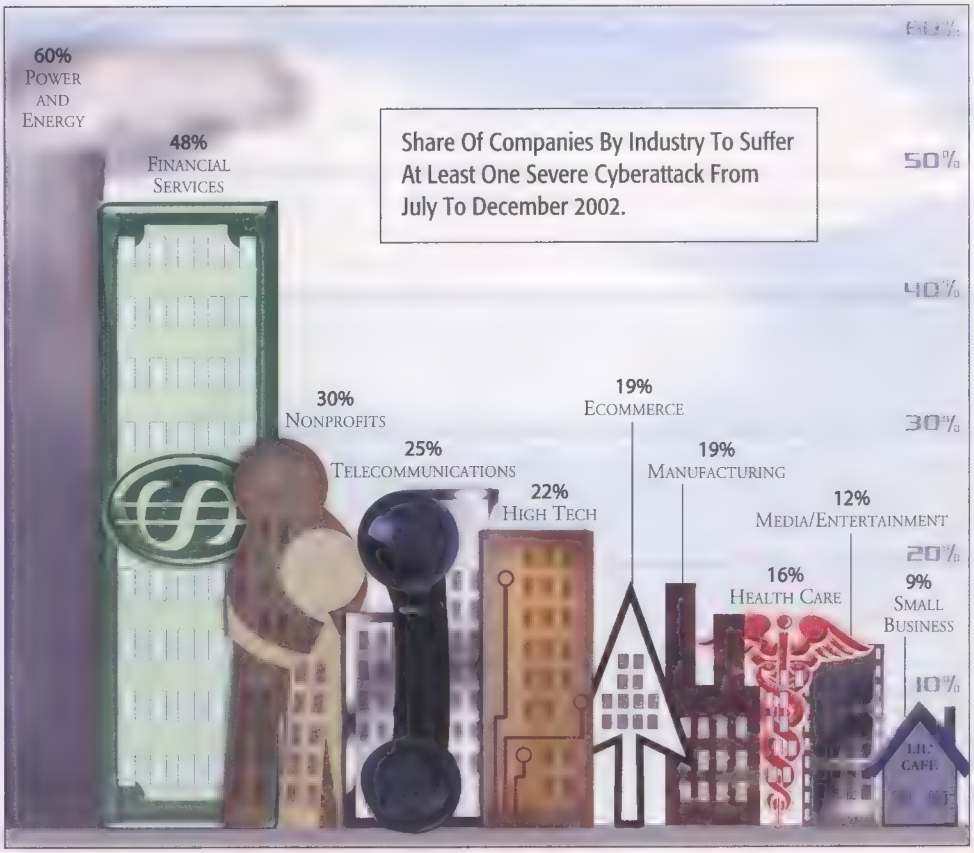
1,096%
Percent change in total U.S. visitors at Cadillac.com the day after its television spots on Super Bowl XXXVII.
comScore/Media Metrix

5175
The amount of daily Internet traffic in petabits expected by the end of 2007 up from 180 petabits (1,000 terabits) per day in 2002.

962
Number of substantial Internet companies that have shut down or filed for bankruptcy since the Web bubble burst in spring 2000.
Webmergers

Power & Finance Draw More Cyberfire

Sure, we hear about hacker break-ins at ecommerce sites or defacements at major media sites, but it turns out that these are not the preferred targets of cybervillains. According to Symantec's recent Security Threat Report, public utilities companies were far and away the most popular cyberattack victims, with more than 60% of these companies experiencing at least one major assault in the last half of 2002. Financial services firms ran a distant second but also showed the sharpest increases. Hackers follow the same patterns as terrorists: They want to penetrate infrastructure and money centers.



Share Of Companies By Industry To Suffer At Least One Severe Cyberattack From July To December 2002.

Source: Symantec

The Saint

by Alex St. John

Nerd Experiments

Alex St. John was one of the founding creators of Microsoft's DirectX technology. He is the subject of the book "Renegades Of The Empire" about the creation of DirectX and Chromeffects, an early effort by Microsoft to create a multimedia browser. Today Alex is President and CEO of WildTangent Inc., a technology company devoted to delivering CD-ROM quality entertainment content over the Web.

Last month I set myself the task of figuring out how to get my PC games into my living room while leaving my PC in the office. Crazy, you say? Well, yes, probably, but it was fun to try. First of all, there has been a lot of talk about using digital wireless technologies to deliver music and video to the living room. Unfortunately, such next-generation solutions don't solve my gaming problem. For example, 802.11b is good for 11Mbps of bandwidth, fine for music, fine for video, but no good for games. The only way to send real-time video over an 11Mbps connection is to heavily compress and then decompress it on the other side. This requires a lot of computation in advance to get the compressed video and a computer on the other side to decompress it before it can be played on a TV. The signal needs to be sent to the TV and input back to the PC in under 1/60th of a second to achieve decent responsiveness. There is no time to compress and decompress the imagery before sending it to the TV. I have to get a raw video signal from my PC, convert it to NTSC format, and deliver it to my TV in the living room. This task first requires a special video card.

> **Without signal interference, I got great real-time sound and video on my TV.**

Here at WildTangent HQ, I have access to almost every video card imaginable. After careful examination of all of my options, I selected the ATI All-In-Wonder 9700 Pro for the principal reason that it comes in a configuration that includes RCA TV-out. I found HP laptops were also great for this experiment because they all come with RCA TV-out, as well. Video cards like the ATI that provide TV-out do the PC video-to-NTSC conversion for me. Another nice feature of these boards is that the Windows Desktop can continue to operate normally on my monitor and I can use a second display surface for the TV, allowing me to use my computer normally in the office while sending video, for example, on the second display surface.

I ordered a wireless Video Sender from X10's Web site. The Video Sender comes in two forms: one that takes coaxial video and sound, and another that takes RGB directly from the monitor. I prefer the RGB variety because it works with any video card that supports dual display modes (the VideoSender is at www.x10.com/products/x10_vk30a.htm).

I could simply run a standard coaxial cable from the PC to the TV and get a great video signal with no wireless gadgetry, except there's no simple way to get sound to the TV without separate stereo wiring. By plugging the X10 video sender into my PC, I could throw the live video and audio signal on a 2.4GHz RF bandwidth about 300 feet. That's great in theory unless you have a 2.4GHz 802.11 hub in your house, a 2.4GHz wireless phone, or any other 2.4GHz appliance competing for the same bandwidth. Without signal interference, I got great real-time sound and video on my TV. Next I had to get a game pad, mouse, or keyboard to work from my living room. The mouse and keyboard options were frustrating because none of them were really designed to work from a long distance. The Logitech Wingman Cordless Gamepad had the best range at about 45 feet, but it's a 2.4GHz device. It's smart enough to avoid the X10 signal by itself, but with 802.11 also running nearby, it added noticeable noise to my image. Finally, I fired up a WildTangent game called Black Hawk Striker, moved its display window to the second display, maximized it, and played it 45 feet from my PC with no wires. Very amusing. I could also go back to my PC and run Word or a browser on it while the game was running on the second display. Unfortunately, the game's frame rate suffered dramatically when, with a friend's help, I tried to do both at once. If any vendors out there have a better way to make this work, please let me know. ■

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These Gizmos Don't Sing It, They Bring It

Summer means water sports, even in the Extreme Hardware arena. If you can spare a bit of water from your plasma TV/Jacuzzi, you can rejuvenate your robot's fuel cell for a few hours. If you'd rather take in your entertainment in a drier venue, we also have a digital projector that could double as a sunlamp.

by Marty Sems

Jacuzzi La Scala

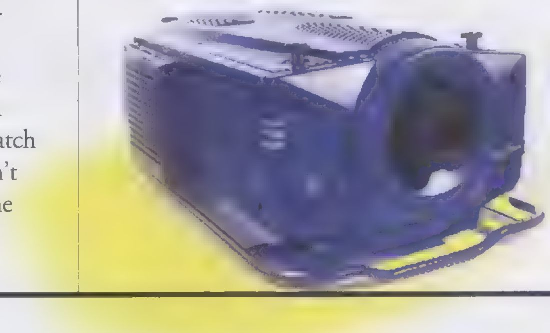
Power users like to multitask. Even away from the desktop, which is happily FlasKing a DVD and managing various downloads, you can find the typical geek thumbing a BlackBerry while pedaling a stationary bike. The next (il)logical step? A Jacuzzi with a built-in 42-inch plasma HDTV, of course. There's room for two in the $29,000 La Scala (www.jacuzzi.com), which is exactly the 125-gallon, 50-inch-long x 52-inch-wide whirlpool we want for Christmas. Surround sound will envelope you as warmly as the jetted water while you enjoy a DVD, CD, or AM/FM radio. A floating remote is the perfect touch. Of course, if you opt to watch all three hours of "Fiddler On The Roof" in your La Scala, don't be surprised if your significant other starts to resemble Yente the Matchmaker by the last reel.

Toshiba ApriAlpha

You can't be an Asian tech giant without at least working on some sort of robot. Here's Toshiba's contribution to the niche. The neat thing about its ApriAlpha robot prototype is that it uses Toshiba's DMFC (direct methanol fuel cell), an innovative power source that's small enough to run notebook-sized mobile devices (www.toshiba.co.jp/index.htm; prices not available). Toshiba says the new fuel cell uses byproduct water from the power-generation process to further dilute the relatively strong methanol solution fueling the unit. That means the thing's gas tank can be much smaller than other fuel cells', as it doesn't need to hold as much water as a typical fuel cell's tank. This advance opens the door for ever-smaller fuel cells, which may eventually supplement rechargeable batteries in small devices. Toshiba hopes to market some form of the ApriAlpha robot by 2005.

Digital Projection Lightning 28sx

Why squint at a plasma screen or LCD measured in inches when you can mark off your viewing screen in feet? Put the theatre back in your home theatre with a xenon arc digital projector from Digital Projection (www.digitalprojection.com). This year's big boy is the Lightning 28sx ($124,995), which outshines the previous 25sx with a total of about 16,000 lumens. Most top-of-the-line projectors only manage 1,000 to 2,000 lumens, so as you can see, there's some serious candlepower in this 4,200-watt sun. The 28sx supports HDTV standards up through 1,080i/24p and has a native resolution of 1,280 x 1,024 (SXGA). Hey, if this shining star was good enough to wow the crowd at the 2003 Grammys, it's good enough for your Red Dwarf marathon party.



CompactFlash Crazy

We Poke, Prod & Push 26 Cards In Our Tests

Born in 1994, CompactFlash cards are a long-lived success story in the unstable world of nonvolatile flash memory formats. Introduced by SanDisk and proliferated by the CFA (CompactFlash Association; www.cfa.org), CF now works with more than 260 digital cameras, from budget to pro-quality models. At least 110 PDAs use CF cards, and hundreds of other products (photo printers, heart monitors, MP3 players, etc.) accept these trim, hardy cards.

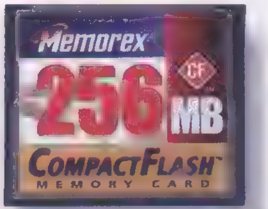
CF cards come in Type I and Type II varieties. The only difference is thickness. Type I cards are 3.3mm thick; Type II cards are 5mm thick. Both use 50-pin connectors and operate at 3.3 or 5 volts, but most products use Type I cards, due to the smaller size.

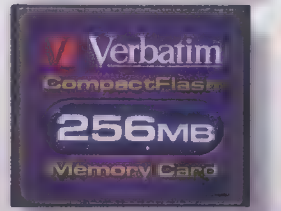
Eviscerated Flash

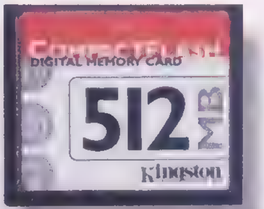
CF cards are flash memory devices with no moving parts. A plastic frame girds two stainless steel faces, and inside is a tiny printed circuit board studded with three 56-pin NAND (Not AND) memory modules and a controller chip that directs data transfer, power management, and ECC (Error-Correction Code) algorithms that preserve data integrity. These controllers regulate a card's activities using the same kind of ATA/IDE interface that helps a motherboard's bus communicate with disk-based storage devices.

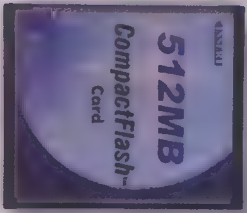
NAND flash memory is typically used because it works well for sequential read/write tasks—making NAND-based CF cards excellent for the orderly write processes of digital cameras. Some companies use NOR (Not OR) memory, which works better for random access, but NOR is more expensive and doesn't have the same capacity potential, so it is often used in various PDAs and cell phones instead.

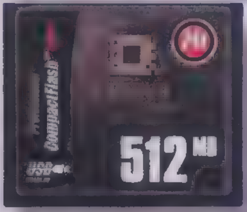
There are two types of NAND: One is MLC (multilevel cell), which stores 2 bits per cell, and the other is SLC (single-level cell), which stores 1 bit per cell. SLC generally has

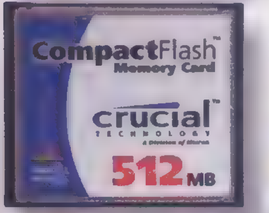


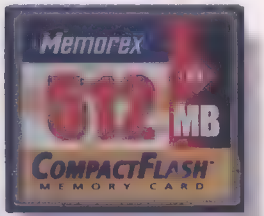












faster sustained write speeds than slightly cheaper MLC NAND. Both types are rated for hundreds of thousands of read/write processes, but a few inevitably die early. Those dead cells won't render the card unusable, though, because the card controller maps out malfunctioning cells to keep the card working.

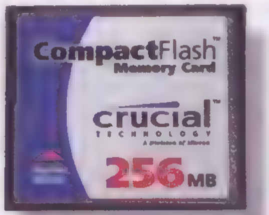
Only a few companies produce the NAND semiconductors used in CF cards, including Toshiba, SanDisk, and Samsung. About 15 manufacturers (Toshiba, KTC, Hyperstone, etc.) create CF card controllers. Thus, various CF cards have very different quality and performance. In fact, some companies use rejected NAND modules in low-cost, nonbranded cards. The ECC qualities inherent to CF structure mean these cards will (probably) work, but you may encounter reliability problems and error messages.

The simple build of CF cards makes them nearly impossible to break; cards can withstand a 10-foot drop and wildly fluctuating temperatures. In addition, the durable connectors let you insert and remove the cards thousands of times with no change in performance.

When buying a card, find a spec list that includes components from brand name companies. If you can't find the component manufacturer, check the warranty. A 12-month or longer warranty usually indicates a better product.

How We Tested

We put 26 cards from 13 manufacturers through our homemade tests. Digital cameras are the primary host devices for CF cards, so we tested our cards in a run-of-the-mill 4-megapixel Canon PowerShot G3 vs. a pricey professional model that would have taken advantage of the superior writing abilities in high speed cards, such as those equipped with Write Acceleration technology from Lexar Media. As we expected, our G3 much preferred certain brands over others; that's because a few CF card controllers simply respond better to the writing techniques of certain cameras. We present our G3 results only to give an idea of just how much speed you might gain or lose with a specific camera-card combination. In some cases, our Canon seemed to prefer cheaper memory.



We also tested each card in a SanDisk ImageMate 6 in 1 Reader/Writer (Hi-Speed USB 2.0) card reader and SanDisk FireWire reader. We formatted each card and transferred files to/from the card after disabling removable device write caching. We tested our 256MB cards by transferring a 200MB file to/from the card three times. We used a 485MB file for our 512MB cards. Capacity did affect the card's speed ranking, ostensibly because cards that handle short bursts of data didn't always fare as well in situations where sustained transfer speeds were more important.

Several cards, including ones from Memorex, Crucial Technology, eFilm, and Perfect Pix, wouldn't cooperate with the SanDisk reader. For these brands, we used Memorex (USB 1.1) and PNY (USB 2.0) readers. We knew introducing new test equipment would skew the rankings, but we did so for curiosity's sake.

The 256MB PNY Optima, SimpleTech, and TwinMos cards took top honors, and the Lexar Media Pro did consistently well. The 256MB Memorex cards were cellar dwellers, but Memorex's 512MB cards did much better, dropping more than four seconds in our RAW test. Others, such as the Smart Modular cards, had nearly identical performance regardless of capacity.

For all of our results, subscribers can read the entire "Keep Your Aces" chart, plus a detailed explanation of our testing procedures, at www.cpumag.com/cpujun03/compactflash.

Performance Results

As we anticipated, our results varied greatly depending on the application. In addition, they didn't always reflect the manufacturers' speed ratings, which are often misleading. It's not uncommon for a less expensive card without a "high-speed" designation to outperform a card fine-tuned for a professional camera. However, cards with high speeds may not always be the best place for prized data.

"In many cases, when we evaluate cards from other vendors, what we have found is that they have [taken] shortcuts to speed up the data transfer," says Dan Le, Lexar Media's director of application engineering. When a CompactFlash card is ready to accept data, it sends a ready signal to the host device. To create a faster algorithm, vendors sometimes program the card to send a false ready signal. This may partially explain why some expensive, name-brand cards performed at average speeds in our tests while some relative unknowns had eye-popping rates. If the host is slow, this shortcut won't cause problems. If the host is fast, though, you may encounter errors because the card can't accept incoming data quickly enough.

Flash To The Future

IDC analyst Michito Kimura says nearly 18 million CF cards shipped last year, giving CF about a quarter of the worldwide flash card market. To date, approximately 68 million CF cards are in use worldwide. Most are Type I, but the trend toward higher-capacity cards means the thicker Type II cards (with more semiconductors) may become more common. However, "As the die size of the NAND flash is reduced, these cards could then become Type I cards," says Paul Wasek, senior marketing manager of PNY's flash media and peripheral products.

Version 2.0 of the CF card specification, published in March, upped the interface transfer rate from 8MBps to 16MBps. By year's end, we may see DMA-speed transfer rates. Ultra DMA (33MBps) rates should appear in 2004.

Bill Frank, CFA executive director, says these improvements are partly why CF cards will be useful for years. In addition, "many companies want to have proprietary card formats on which they can collect royalties and even restrict the manufacturing of the cards to only two or three companies. SD, Memory Stick, and xD cards are all proprietary and will be manufactured by only two or three companies," says Frank.

Such strategies may limit the product base for some card types and hamper attempts to usurp CF on the flash memory throne. Translation: Don't be afraid to invest in high-capacity, high-speed CF cards because you will probably get years of benefit from their performance in your CF-compatible toys. ▲

by Nathan Chandler

Keep Your Aces ●●●●●●●●●●●●●●●●●●●●

Of the 26 CompactFlash cards we tested, some brands stood out as clear winners. We've listed the top five performers here in each of our tests. If you're curious, subscribers can check out the full chart of test results online at www.cpumag.com/cpujun03/compactflash.

256MB Cards Write Speeds

Reader	USB 1.1		USB 2.0		FireWire	
		KBps		KBps		KBps
	Memorex*	952	TwinMos	2,178	Delkin eFilm Pro	3,357
	Crucial Technology*	950	Lexar Media Pro	2,133	Transcend	3,357
	SimpleTech	898	Delkin eFilm Pro	2,111	Lexar Media Pro	3,356
	Lexar Media Pro	878	PNY Optima	2,068	TwinMos	2,805
	SanDisk Ultra	864	SanDisk Ultra	2,048	SimpleTech	2,497

*Incompatible with SanDisk card reader; substituted Memorex reader

256MB Cards Read Speeds

Reader	USB 1.1		USB 2.0		FireWire	
		KBps		KBps		KBps
	Transcend	2,409	Perfect Pix**	6,826	Lexar Media Pro	5,688
	Lexar Media Pro	2,327	Memorex**	5,389	Perfect Pix	5,688
	Smart Modular	2,327	PNY Optima	5,251	Transcend	5,251
	TwinMos	2,275	TwinMos	5,120	Delkin eFilm Pro	5,251
	PNY Optima	2,226	Crucial Technology**	5,120	Delkin eFilm	5,120

**Incompatible with SanDisk card reader; substituted PNY reader

512MB Cards Write Speeds

Reader	USB 1.1		USB 2.0		FireWire	
		KBps		KBps		KBps
	SimpleTech	893	Lexar Media Pro	2,687	Lexar Media Pro	3,680
	Crucial Technology	893	Delkin eFilm Pro	2,217	Delkin eFilm Pro	3,678
	Lexar Media Pro	870	PNY Optima	2,140	Transcend	3,356
	Delkin eFilm Pro	857	TwinMos	2,140	TwinMos	2,805
	Transcend	856	Memorex**	2,122	SimpleTech	2,713

**Incompatible with SanDisk card reader; substituted PNY reader

512MB Cards Read Speeds

Reader	USB 1.1		USB 2.0		FireWire	
		KBps		KBps		KBps
	Transcend	1,045	PNY Optima	3,310	Perfect Pix	5,340
	TwinMos	981	Transcend	3,104	Delkin eFilm Pro	5,283
	SimpleTech	958	Lexar Media Pro	3,010	Transcend	5,282
	Delkin eFilm*	923	Memorex**	2,974	Lexar Media Pro	5,120
	Memorex*	923	Kingston Technology	2,353	PNY Optima	4,822

*Incompatible with SanDisk card reader; substituted Memorex reader

**Incompatible with SanDisk card reader; substituted PNY reader

256MB Cards Camera Write Speeds

JPEG Image		RAW Image	
	Seconds		Seconds
SimpleTech	17.42	TwinMos	17.95
TwinMos	17.89	PNY Optima	18.37
PNY Optima	18.47	SimpleTech	18.50
Sandisk Ultra	18.52	Lexar Media Pro	18.58
Lexar Media Pro	18.69	Delkin eFilm Pro	18.85

512MB Cards Camera Write Speeds

JPEG Image		RAW Image	
	Seconds		Seconds
Memorex	18.20	PNY Optima	17.88
PNY Optima	18.22	Lexar Media Pro	18.02
SimpleTech	18.33	Memorex	18.09
Crucial Technology	18.34	Transcend	18.28
Lexar Media Pro	18.35	Delkin eFilm Pro	18.41

VIA KT400A

KT400A
$150
VIA
+1 (415) 389-1700
www.via.com.tw
Preview: No Rating

First Look PREVIEW

For a while, it seemed as though VIA was the only game in town when it came to chipsets for AMD's Athlon/Athlon XP. Then NVIDIA released its nForce2 platform, and it's been all quiet on the eastern front (Taiwan) since then. NVIDIA has kept a clear grasp on the socket A performance/enthusiast market, and gamers keep on pairing their Athlon XP with nForce2. So what's with VIA's response? It's late, but it's finally here in the form of the KT400A chipset.

The new KT400A is a pin-compatible drop-in replacement for the KT400. The northbridge is markedly the same as what came before it: AGP 8X support, a 266/333MHz FSB, and support for DDR200-400. The only real change is to the memory controller, which is still based on a single channel but now with VIA's FastStream 64 technology. Deeper command, prefetch, and data buffers allowing for more efficient data flow from memory to the CPU were added.

The reference preview board is equipped with the same old VT8235CE southbridge found on the KT400 because the new VT237 is not yet ready. But just to get you in the mood, the newer VT8237 will add Serial ATA support natively (like Intel's 875) instead of discretely as in the past. USB 2.0 ports will be bumped up from six to eight, but the six-channel audio controller will be carried over from the VT8235CE. Linking the north and southbridges together is VIA's new Ultra V-Link interconnect. It improves upon the older V-Link by basically doubling the bandwidth from 533MBps to 1.06GBps even if we've still got some way to go before the original V-Link's capabilities hit the wall.

The KT400A's performance isn't earth shattering, but it does bring VIA back into the frame with a decent and yet cheaper competitor to nForce2. But it's probably going to take more than "slightly slower than the nForce2 but cheaper" to convince Athlon XP owners to jump back in VIA's camp. ▲

by Alex "Sharky" Ross

PRISMIQ MediaPlayer

MediaPlayer
$249.95
PRISMIQ
(650) 685-2100
www.prismiq.com
CPU CPU CPU C

PRISMIQ's debut offering, the MediaPlayer, is one of the few "convergence" boxes for the television that impresses. MediaPlayer has audio, composite video, and S-Video jacks that plug into an available spot on your television or VCR. There is also an Ethernet jack and a PC Card slot. The MediaPlayer's PC-based client software streams your gigs of music, movies, and photos across the network and into a simple interface on your TV.

Armed with a Netgear Wi-Fi card, the MediaPlayer recognized our WLAN and found its client software. Unfortunately, we made the mistake of letting this software scan the PC, whereupon it cataloged hundreds of Temporary Internet files images. A checkbox to exclude system and common TEMP folders would help here. Creating favorites lists within the three media types is simple, but managing the full media database in general is a clumsy process with few controls.

You navigate the MediaPlayer via shortcut buttons and an omnidirectional pad on both the infrared keyboard and remote control, and there is even access to a basic Web browser and AIM client. You can start playing an MP3 and then switch over to look at your photos or surf the Web with the music still running in the background. We appreciated that the MediaPlayer software uses cookies to remember personal data, just like a conventional browser, and being able to customize Web favorites saves on a lot of awkward typing.

Music playback was solid, and the MediaPlayer performed perfectly until we tried to play a moderate bit-rate video clip. This flooded our bandwidth, and the device essentially locked up, forcing us to reset it. With a wired connection, such problems vanish; future support for 54Mbps wireless should also help a lot. We hope that PRISMIQ will soon expand its file support beyond MP3 audio and MPEG-1 and -2 video.

Overall, PRISMIQ's MediaPlayer is an excellent gadget that we expect will get even better. ▲

by William Van Winkle

CPU Ranking: 0 = Absolutely Worthless CPU CPU C 2.5 = Absolutely Average CPU CPU CPU CPU CPU 5 = Absolutely Perfect

I 875P (Canterwood)

Until now, the best performance from a Pentium 4 processor could only be had when pairing it with an RDRAM-based platform such as the 850/850E. It's been a long time coming, but for more than a year now, Intel has crossed RDRAM off its road maps in favor of dual-channel DDR. For the high-end enthusiast market, Intel will soon be releasing its 875P chipset (formerly known as Canterwood) with a bevy of new features and performance enhancements that finally better the 850E. AGP 8X, Hyper-Threading, and six-channel audio support are of course fully inclusive in the 875P chipset, but let's take a look-see at the sexy stuff.

Sporting a quad-pumped 200MHz (thus 800MHz) frontside bus smashes the old bandwidth ceiling of 4.2GBps for the 850E and its 533MHz FSB. 6.4GBps is now the theoretical max. To make things nice and synchronous, the 875P's MCH is equipped with two DDR400 memory channels that can also deliver—you guessed it—6.4GBps worth of bandwidth. What a cute couple. Because the 875P will be aimed at workstations also, the chipset will support ECC memory. 875P will also offer something else that 865 will do without: Performance Acceleration Technology (PAT). Who is PAT? He's a marketing bloke embedded in the top-performing 875P that distinguishes the chipset from 865, due to speed binning. With 875P, Intel can be more aggressive with the memory controller, knocking two clocks off every chip select, which ends up improving overall performance by reducing memory access latency.

Intel whipped up a new I/O controller hub for 875P, with its new southbridge (ICH5), which provides Serial ATA capabilities with two ATA 150 channels. An ICH5R will also be available with Canterwood-based boards that harbor Serial ATA RAID 0 functionality. (RAID 1 is on its way via future BIOS updates.) Eight USB 2.0 ports are supported internally, which should just about cover all your USB needs.

Gigabit Ethernet support in the past has usually taken the short bus via 32-bit 33MHz PCI slots, which is all fine and dandy if you're only going one way. Try getting full 1Gbps duplex support, and you'll hit the PCI bus' bandwidth ceiling head on, hence you're going to need 2Gbps of bandwidth to get the job done, which isn't possible because PCI buses max out at 1Gbps. To tackle this bandwidth problem, Intel popped a CSA (Communications Streaming Architecture) bus into the MCH, which connects it to the ICH and results in more efficient use of data paths. The CSA bus offers that required 2Gbps of bandwidth so you don't have to take the short bus (PCI route) anymore and can obtain those full duplex Gigabit transfers. CSA obviously frees up the PCI bus for other devices that aren't as taxing.

Now, these improvements don't come free, and if you're using a 400MHz FSB P4, you'll either need to wait for Springdale (865), which is due out soon, or upgrade to a 800/533MHz FSB processor. The current best fit is the P4 3.0C, which we used for the purposes of this review but may not be out by the time you read this, thanks to some last-minute anomalies that Intel discovered. Oops. If you aren't all that interested in all the new MCH and ICH features of 875P and already own a top-end P4 and 850E platform, the performance gains with 875P and an 800MHz FSB P4 are going to be pretty slight; you might want to hang on to what you've got to save some money. Wait until faster 800MHz FSB P4s come out (might be awhile yet, though) before you chuck out your old RDRAM-based gear.

If you're not sure and think the high asking price of 875P is too heavy on your D&G wallet, sit tight for cheaper 865 (Springdale) platforms to hit the market. But for those of you who want it all and live in a world where cost is no object when it comes to getting faster performance, the 875P fills the bill perfectly. With future driver (especially Intel's Application Accelerator) and BIOS updates, the 875P is truly going to be the best-performing Intel platform for high-end gamers such as yourselves. . . . So much so that it once again widens the gap between the P4 and the Athlon XP, and this time without the need for RDRAM that had so many enthusiasts up in arms. AMD will need to get its skates on with Athlon 64. ▲

by Alex "Sharky" Ross

875P
$200+
Intel
(408) 765-8080
(800) 538-3373
www.intel.com

CPU First Look

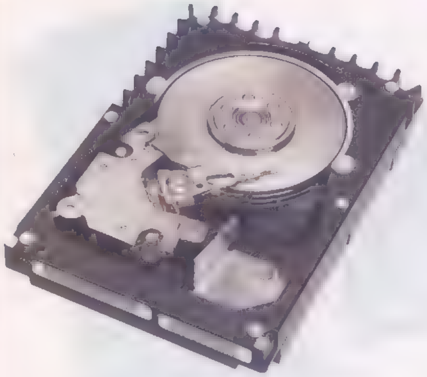
Canterwood Scores

	Quake III Arena: 640 x 480	Unreal Tournament 2003: 1,024 x 768	Commanche 4: 1,024 x 768	Serious Sam: TSE 1,024 x 768SP1	SiSoft Sandra 2003 Memory Bandwidth ALU	SiSoft Sandra 2003 SP1 Memory Bandwidth FPU
P4 3GHz DDR400	410	226	64	121	4895	4957
P4 3.06GHz PC1066	381	219	60	115	3374	3368
Athlon XP 3000+	315	213	54	122	2753	2620

All tests were run with a Radeon 9700 Pro, Windows XP SP1, and DX9.

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

Fujitsu MAS3735NP SCSI 73GB



MAS3735NP SCSI 73GB
$718 (online price)
Fujitsu
(800) 626-4686
(408) 432-6333
www.fcpa.com

Fujitsu's MAS series of SCSI drives breathes the rare air of the 15,000rpm spindle speed summit. Seagate is typically the king of this hill with its Cheetah series, such as the Cheetah 15K.3 73GB. Be that as it may, Fujitsu's MAS3735NP knocks this kitty down a peg, if not completely off the mountain.

Our 68-pin MAS3735NP is a 73.5GB drive with an 8MB cache buffer. Like most hyperspeed SCSI drives, this one uses smaller diameter platters than typical 3.5-inch EIDE drives. The MAS3735NP uses four 2.75-inch platters with areal densities of 33.1Gb per square inch, meaning they're small but dense. With smaller disks to read, the Fujitsu's heads don't have very far to travel. Add this to the breakneck 15,000rpm spindle speed, and you get very quick random access times, along the lines of 5.4ms in our tests.

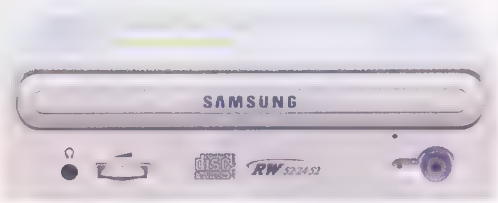
Keeping the hot-blooded MAS3735NP cool and suspended above the work surface, we ran a few tests using a system with a 2.67GHz 533MHz FSB P4, an Intel D845GEBV2 mainboard, 384MB of PC2700 DDR, an Adaptec 19160 Ultra/160 SCSI card, and WinXP Pro SP1.

WinBench99 reported the Fujitsu's Business Disk score as 12,000KBps, which edged out the Cheetah 15K.3 by about 1.5MBps. However, the Fujitsu opened up a can of whoop-rump with a 38,500KBps High-End Disk result, about a third faster than the Seagate's score, which admittedly was taken from an older system.

HD Tach 2.61 said the Fujitsu peaked at 67.3MBps average reads (70.7MBps maximum) and 44.9MBps average writes (57.8MBps maximum). These scores are close enough to the Cheetah's to tickle its whiskers. I'm suspicious of a max read rate so close to the average, but then there's less circumferential difference between middle and outer tracks than there would be in larger platters. ▲

by Marty Sems

Samsung SW-252B CD-RW 52X/24X/52X



SW-252B CD-RW 52X/24X/52X
$99
Samsung
(800) 726-7864
(201) 229-4000
www.samsungusa.com

Samsung optical drives habitually come with 8MB total caches, which, along with stalwart performance and reliability, is a good selling point. Watch out with the SW-252B, though. Samsung says you'll get 8MB in the retail drive but only 2MB in the bulk drive. In other words, be sure you're buying what you think you're buying online.

This 52X/24X/52X Samsung isn't quite as fast at CD-R burning, reading, or accessing data as Lite-On's 52X, although it proves as good or better in CD-RW writing speed. Nero CD Speed 1.02 pegged this Samsung's average read rate at 34.2X using CAV (46.2X maximum), its random access time at 105ms, and its full-stroke access time at 178ms. Using Nero 5.5, the SW-252B wrote a 700MB CD-R in 3:02 (minutes:seconds) and a 639MB CD-RW in 4:43. Our test PC had a 2.67GHz 533MHz FSB P4, an Intel D845GEBV2 mainboard, 384MB of PC2700 DDR, and WinXP Pro SP1.

Ironically, the SW-252B's main competition seems to come from Samsung's own 48X/24X/48X/16X RW combo drive, the SM-348B. Despite the lower numbers on the box, the SM-348B offers significantly faster CD-RW burns (4:00 even), faster random accesses (88ms), and DVD playback. And it does it for about the same price.

The SW-252B does offer JustLink buffer underrun protection, Samsung's DVA (Dynamic Vibration Absorber) technology, and Nero 5.5/InCD. As of this writing, Samsung's site has a typo to the effect that this drive supports DVD-R and DVD-RAM. It can't, as Samsung replied to our query and we proved with a few video DVD-Rs we had on hand. Look for a Samsung marked "RWcombo" if DVD playback is something you want—specifically, the plucky SM-348B. ▲

by Marty Sems

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

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With a TDK Indi DVD burner and DVD recording media, creating videos and photo slideshows is powerfully simple. Add music, narration and sound effects to give your BIG footage a fresh cut. Customize every element or kick back while the software handles the details. Create Hollywood style DVD videos, back up data and more. Records DVD and CD media.

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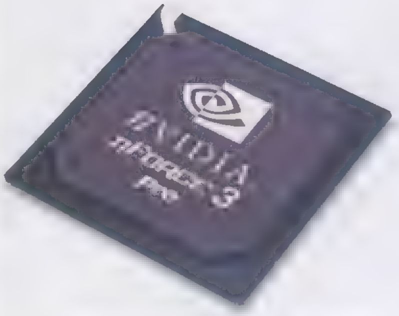
NVIDIA nForce3 Professional



nForce3 Professional
No Price Available
NVIDIA
(408) 486-2000
www.nvidia.com
Preview: No Rating

CPU First Look PREVIEW

Last year, we mentioned NVIDIA's plans for nForce support of the long-awaited 32-bit/64-bit transition poster child, AMD's "Hammer" CPU series. Now that Opteron (formally known as "SledgeHammer") is off the launch pad, we can talk about NVIDIA's nForce3 Professional "Platform Processor," which has been designed specifically for the 1P (single processor) version of Opteron and is optimized to work with NVIDIA's Quadro GPU for workstations.

As AMD has migrated the dual-channel DDR memory controller and other chipset features from the traditional northbridge onto the Opteron, NVIDIA has managed to cram everything else onto a low-latency, single-chip solution with a dedicated high speed (up to 3.6GBps) HyperTransport link for communication with the CPU. With no onboard graphics processing, the nForce3 Pro relies on a high-powered add-in GPU board for graphics muscle, which is where NVIDIA's Quadro lineup comes into the picture. Combining graphics, audio, networking, and storage drivers into NVIDIA's hefty UDA driver package, nForce3 Pro incorporates enterprise-class 10/100 and Gigabit Ethernet networking and hardware-accelerated RAID 0,1, and 0+1 solutions.

According to NVIDIA, nForce3 Pro 150 chips are available now, and ASUSTeK, NVIDIA's announced motherboard partner, says nForce3 Pro 150-based SK8N motherboards should start mass production in June, well ahead of the 1P Opteron's anticipated Q3 availability. The pin-compatible nForce3 Pro 250 chips with the addition of Gigabit Ethernet and Serial ATA support will be available to motherboard OEMs this fall, with boards appearing soon after. The long list of workstation system integrators pledging support for nForce3 Pro includes Alienware, so if there is gaming goodness to be had, we shall surely hear about it. ▲

by Joan Wood

NVIDIA GeForce FX Go Mobile GPU

GeForce FX Go Mobile GPU
No Price Available
NVIDIA
(408) 486-2000
www.nvidia.com
Preview: No Rating

CPU First Look PREVIEW

ATI and NVIDIA have both announced mobile DX9 parts, and we have seen some behind closed doors. Though it might be awhile before you get your mitts on one, these look to be the first generation of mobile GPUs that will run current games at playable speeds.

The mainstream GeForce FX Go5200 (NV34M) 0.15-micron, full DX9 part runs at 300MHz core clock and 300MHz DDR memory clock (effectively 600MHz). The GeForce FX Go5600 (NV31M) is a 0.13-micron, 350/350MHz full DX9 part. Besides speed, the main difference between the two is the lack of NVIDIA's Intellisample technology, with advanced anti-aliasing and anisotropic filtering and color and Z compression implementation, in the mainstream Go5200 part. Both feature AGP 8X support.

NVIDIA anticipates GeForce FX Go's advanced GeForce FX/CineFX architecture will double the performance of GeForce 4 Go for cinematic 3D gaming, and EA has adopted NVIDIA mobile GPUs as its mobile test reference standard for games. Other than DDR-II, which is only supported on GeForce FX 5800, the FX Go5600 supports the full GeForce FX highly programmable, high-precision 3D technology.

The GeForce FX Go's enhanced video processing engine adds motion adaptive deinterlacing, HDTV out, video anti-aliasing, overlay gamma, and MPEG2 encode hardware assist to the already present MPEG video deblocking; integrated TV encoder; full MPEG2 hardware decoding; advanced digital vibrance control; and enhanced nView support for LCD, TV, DVI, and CRT. Improvements to NVIDIA's PowerMizer (version 3.0) power-management technology, including more aggressive clock gating, have been so fruitful that elements of it have been migrated over to enhance desktop performance.

NVIDIA lists Quanta, Wistron, Medion, Toshiba Computer Systems Group, and FIC as among those companies planning GeForce FX Go-based products, and notebooks featuring the new GPUs may be available from Toshiba and Medion soon. ▲

by Joan Wood

Apple iMac 17-inch SuperDrive

Surely you remember your first time. You were in your first year of college, it was late at night, and the shining moon guided you across campus to the 24/7 computer lab. You chided yourself for not getting started on your midterm paper sooner when you saw that all the DOS machines were taken. The only available computers were a handful of Apples. You used an Apple grudgingly at first, but over time, it became your lab computer of choice. Eventually you graduated and succumbed to the corporate world of PCs, and sweet lab memories faded.

Now Apple is back with yet another update to its popular iMac lineup: the 17-inch wide-screen iMac with SuperDrive. And it's time for you to take notice, even if you're firmly entrenched in the world of Windows. Not only is the current iMac an improvement on previous generations, but its Mac OS X v.10.2 (aka Jaguar) and application suite make the PC-to-Apple transition easy.

Specifications. The iMac is built around a 1GHz PowerPC G4 processor on a board with 1GB of DDR266 SDRAM. The system includes an 80GB Ultra ATA hard drive and Apple's crown jewel of an optical drive: the SuperDrive, which combines CD-RW and DVD-R/RW functionality. The SuperDrive is actually a Pioneer DVR-A05 that handles DVD-R/RWs at 4X/2X/12X and CD-R/RWs at 16X/8X/32X. Audio is integrated into the iMac's motherboard, and a pair of Apple Pro speakers provides decent stereo sound.

The onboard NVIDIA GeForce4 MX graphics processor with 64MB DDR provides video for the gorgeous 17-inch wide-screen LCD. The screen's optimal/native resolution is 1,440 x 900, which makes letterbox video fill the screen and leaves ample room for working with multiple documents or windows simultaneously. The display accommodates 800 x 600 (stretched or normal), 1,024 x 640, and 1,024 x 768 (stretched or normal) resolutions, as well. The only other display controls are for brightness, number of colors, and color profile.

The plain-Jane 17-inch iMac runs $1,799. The model I looked at costs $2,348, though, because it includes an AirPort Extreme Card (which allows for 54Mbps interaction with Apple's 802.11g AirPort Extreme Base Station or slower interaction with Windows-based 802.11b), a Bluetooth Module, and two 512MB DDR266 SDRAM DIMMs (as opposed to the lesser iMac's single 256MB module).

The iMac also comes with a USB optical mouse, USB keyboard, and a boatload of ports, including five USB 1.1, two FireWire, and one each of the following: Apple VGA; phone line; 10/100Base-T Ethernet; Apple speaker minijack; headphones; audio line in (which takes in sound from an analog source!); and, of course, power.

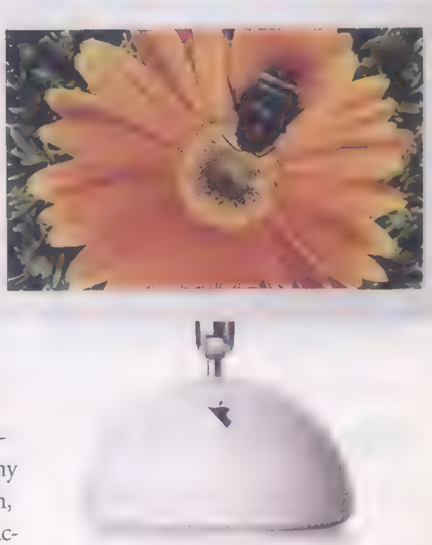
Design. Here's where we must face two important, opposing facts: (1) Because of its all-in-one nature, the iMac isn't the answer to many power users' needs, and (2) because of its stylish, compact design, it makes for an extremely attractive computer and all-purpose digital hub for anyone's home or office. Plus, the high-end iMac is still the most powerful overall package compared with its all-in-one-PC competition.

As with previous iMac versions, this one is heavy and sturdy; you can lift it by the gooseneck that attaches the flat-panel monitor to the half-globe base. You can also adjust the screen position with one finger. Also like previous iMacs, this one doesn't have a 3.5-inch floppy drive. (Hint to Apple: Add a USB storage stick as a purchase option.)

Performance. Setting up the iMac was incredibly easy, taking just a few quick steps: unpack; plug in; attach speakers, mouse, and keyboard; and turn on. The system provided hours upon hours of solid, reliable performance. It took 1:25 (minutes:seconds) to start up, a mere 10 seconds to shut down, and 3:50 to burn 600MB worth of data to CD-R. DVD movies looked brilliant on-screen, and the screen automatically adjusted for nonletterbox video. The Apple Pro speakers don't pump out a wall of sound for larger areas, but in a home or other intimate setting, they fill the room with rich sound.

Final word. This is the best all-in-one system going. It comes with Apple's 90-day phone support and one-year repair warranty, which you can extend to three years if you spend an extra $169 for the AppleCare Protection Plan. ▲

by Cal Clinchard



iMac 17-inch SuperDrive

$2,348
Apple
(800) 692-7753
(408) 996-1010
www.apple.com

Features

Processor: 1GHz PowerPC G4

RAM: 1GB DDR266 SDRAM

Hard Drive: 80GB

Optical Drive: SuperDrive (combo DVD-R/RW and CD-RW)

Connectivity: Modem; Ethernet

Chassis Type: All-in-one

System Use: Personal Use

Final Word: The best iMac yet; prices start at $1,799, this model is higher because it has an AirPort card and Bluetooth support

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

M-Audio Revolution 7.1

Revolution 7.1
$119.95
M-Audio
(800) 969-6434
(626) 445-2842
www.m-audio.net

Creative Labs has been losing ground the past several months to money-saving sound cards from Philips and Hercules. Creative still rules the market's high end with its excellent Audigy 2 cards, but its turf is being challenged. I recently received an excellent 7.1 audio card from M-Audio that should generate a lot of interest among PC audiophiles.

The Revolution 7.1 uses an ICEnsemble digital signal processor and supports DirectX and A3D. The card also processes Dolby Digital 5.1 and DTS audio and includes a digital coaxial connector, in addition to the usual inputs (no optical connection, unfortunately). The card works with WinMe/2000/XP and Mac OSes.

The Revolution 7.1's advantages over the Audigy 2 included support for eight channels of audio. The Audigy2 only supports seven. (What's that all about?) The Revolution 7.1's signal-to-noise ratio of 107dB edges out the Audigy 2's 106dB ratio. Both cards are capable of playing 24-bit, 192KHz audio, but here's the kicker: The Revolution 7.1 costs less than the Audigy 2.

The 7.1 includes a nice little audio utility that lets you set up the speaker environment and tweak the sound to your liking. It's not as extensive as the utilities included with a Sound Blaster card, but it's not bad. I tried it while listening to some audio tunes, and they sounded fine.

I especially liked how the Revolution 7.1 handled the audio in our Serious Sam test game. The bass really thundered, and every sound was as crisp as a frozen sheet of paper. The audio clarity was excellent and didn't diminish when watching "The Matrix" on DVD. This is where the card really shines. The card's eight channels of audio and support for DTS and Dolby Digital, are clear signals the card is made for DVDs.

The 7.1 literally rocks. I've been a fan of Creative Labs' cards for years, but I may change allegiances after hearing the Revolution. ▲

by Michael Sweet

Palm Tungsten T

Tungsten T
$399
Palm
(800) 881-7256
(847) 262-7256
www.palm.com

Although other manufacturers pack more and more entertainment features into portability nightmares, Palm continues to produce small, no-nonsense PDAs that get the job done and disappear into your pocket. Palm is targeting its new Tungsten T at businesses, but any PDA user can appreciate the device's 144MHz processor and tiny footprint. The Tungsten T is also the first Palm to include Palm OS 5 and integrated Bluetooth.

The T's front side has four PIM shortcut buttons and a directional pad with a button in the center that doubles as a double-tap and Back button. The buttons navigate the OS even after the snap-on protective cover is on. The Recorder button and microphone jack are on the left.

The device is so small (4 inches tall x 3 inches wide x 0.6 inches deep) because the directional buttons cover the Graffiti writing area, instead of sitting below it. To write with your stylus, you can slide the front panel back, increasing the length by 0.8 inches. The directional and PIM buttons remain active when you slide the panel. The Tungsten T is the last Palm device to include Graffiti software. The Tungsten W will include Palm's new Jot software.

If you want to listen to MP3s, you'll need to purchase additional software, which you can find on Palm's Web site. Palm also recently released updates that increase MP3 sound quality and fix a minor issue with the Digitizer. If you plan to listen to MP3s, you should probably get an SD expansion card. The Tungsten T has only 14MB of RAM available (16MB total), and that's before you load the Tungsten's free software.

As usual, Palm ships plenty of software in the box, including BlueBoard, which lets you collaborate on a white board with other Bluetooth PDAs. There's also the all-important DataViz Documents To Go, and the Tungsten T also includes the standard cradle.

Although it doesn't have as much internal memory as some high-end Pocket PCs, the versatile Tungsten T is the best Palm device so far. ▲

by Joshua Gulick

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

Auravision EluminX Illuminated Keyboard

Your current keyboard may have scroll wheels, shortcut keys, and media buttons, but does it glow in the dark? If you compute in dim or dark environments, you know how frustrating it can be to have to turn on the light before you can find and press INSERT. Auravision addresses the need to see the keyboard in a dark room by offering the EluminX Illuminated Keyboard.

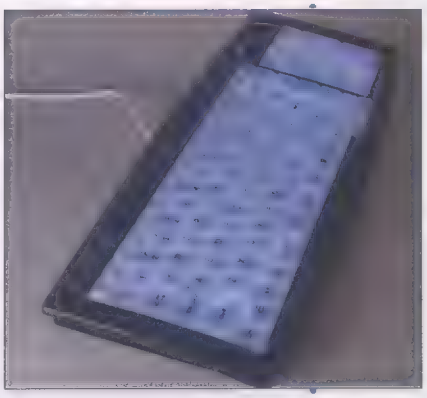
Auravision's ElectroLuminescent technology, which lights the EluminX, debuted in military and other governmental computing devices. Auravision offers the EluminX in three colors: bone, black, and silver. Currently, the only light colors are aquamarine and sapphire blue, but Auravision plans to offer clear, dark blue, orange, red, and violet.

The EluminX isn't nearly as slim as its name suggests. The QWERTY board is a little smaller than a traditional keyboard, but the keys are about the same size as keys on a standard keyboard, if not a little closer to each other. The EluminX also includes the directional keys, Function keys, and a numerical keypad. Three green lights indicate the NUM, CAPS, and SCROLL LOCK statuses.

In full lighting, the clear, plastic keys appear almost white. When I turned off the lights, the entire keypad was blue. The keys are bright, even if a little light enters the room through blinds or a doorway, so you won't have to compute in a cave to enjoy the board. In a pitch-black room, the keys emit enough light to let you see nearby objects and read printed text. Monitors also emit light, so I placed a 19-inch monitor onto a desk and pushed the EluminX up to the monitor to see if the keyboard's brightness suffered. The brightness didn't seem to diminish at all.

I like this keyboard. The EluminX isn't very exciting when the lights are on, but it's comfortable, lets you see the keys in dimly lit environments, and comes alive in the dark. ▲

by Joshua Gulick



EluminX Illuminated Keyboard
$99.95
Auravision
(866) 358-6469
www.eluminx.com
● ● ●

Canon i950 Photo Printer

No company produces a bigger variety of inkjets than Canon. Here's another—the i950 is the current culmination of frantic efforts to create a perfect photo printer.

The i950 leaves a good first impression. Its metallic cover is visually arresting, and both the input and output paper trays fold neatly into the primary case, a trait that makes this printer compact and helps defend against dust attacks during idle periods. Open the main cover and you'll see the six individual color tanks and 3,072-nozzle print head that spews droplets as small as two picoliters.

Like all current Canons, the i950 was fast. My tests proved that this printer creates borderless 4- x 6-inch prints in about 45 seconds and a full-page photo in just more than a minute and a half. It's easy to see that the i950 is geared toward photo printing because draft text speeds were relatively slow (5.6ppm), and my basic mixture of text and clip art printed at only 1.9ppm.

Print quality was good across the board. Text wasn't laser-perfect, but even draft mode would work in an office setting, and clip-art colors were accurate. Photo color wasn't as lush as I prefer, but it will please most users, especially those not accustomed to the improved quality that comes from a six-color engine.

The driver software was loaded, too. The Vivid mode was especially fun, as it created eye-popping colors to liven up images with just so-so hues. I also liked the Quiet mode that makes this printer almost dead silent, and though this feature hardly seems necessary on a product that is already whisper quiet, it will come in handy in peaceful environs.

This printer is admittedly a bit expensive. But it's also fast, smooth, and devoid of all the unnecessary extras packed into so many photo printers these days, making it a great buy. ▲

by Nathan Chandler

i950 Photo Printer
$250
Canon
(800) 652-2666
(714) 438-3000
www.usa.canon.com
● ● ● ●

CPU Ranking: ○ 0 = Absolutely Worthless ● ● ◐ 2.5 = Absolutely Average ● ● ● ● ● 5 = Absolutely Perfect

IBM ThinkPad T40 1.6GHz

ThinkPad T40 1.6GHz
IBM
$3,249
(888) 746-7426
(914) 499-1900
www.ibm.com

Features

Processor: 1.6Ghz Intel Pentium-M

RAM: 512MB/2GB

Hard Drive: 80GB

Optical Drive: DVD/CD-RW Combo

Connectivity: Gigabit Ethernet, 802.11a/b, Modem

Display: 14.1-inch SXGA+ TFT

System Use: Personal

Final Word: Nice job of balancing portability and performance makes this a good choice for anyone who works more outside the office than in it.

Intel's recently released Centrino platform means it's time for a parade of new notebooks using some or all of the new technology encapsulated in the platform. IBM's ThinkPad T40 line is one such example.

Specifications. The high-end ThinkPad T40 we tested uses an IBM 802.11a/b card in place of Intel's wireless networking card. As a result, our model didn't bear the Centrino brand name, although it did use the new Pentium-M processor and the 855PM chipset.

Our review unit included the high-end 1.6GHz Pentium-M processor. This is far less than the higher clock speeds found in Pentium 4-M processors, but the Pentium-M has a few tricks up its sleeve to compensate for its lower clock speed. The 64KB of L1 cache and 1MB of L2 cache, for instance, drastically improve performance.

Our unit also included the 855PM chipset that includes support for a 400MHz front-side bus and DDR SDRAM. Our unit had 512MB of PC2100 DDR SDRAM and is upgradeable to as much as 2GB.

Although our T40 model doesn't qualify as a Centrino notebook, the 802.11a/b network card provides a bit more flexibility. IBM has replaced the standard 10/100 Ethernet card with a speedy new Gigabit Ethernet card. A modem is available if you need to use dial-up.

Our T40 model had an 80GB hard drive and a new UltraSlim modular bay with a DVD/CD-RW combo drive. The new modular bay is only 9.5mm thick instead of 12.7mm. That 3.2mm may not sound like much, but it does make a difference and helps make the T40 slender. Our T40 also included one of the fastest mobile graphics chips available, the ATI RADEON 9000, but with just 32MB of video memory rather than 64MB.

A new 9-cell lithium-ion battery came with our T40. As you'll see, the larger battery, combined with Intel's more battery-friendly technology, provides a significant improvement in battery life.

Design. The T40 strikes a nice balance between portability and performance. The notebook measures just 1 inch high (when closed) x 12.2 inches wide x 10 inches deep and weighs just 4.9 pounds.

The 14.1 SXGA+ TFT display was bright and colorful. SXGA+ (1,400 x 1,050) provides for sharp images and text. DVD video looked great, although I noticed that playback seemed to stutter a bit during camera pans.

The speakers mounted in the system's front bezel provided decent sound for a notebook. DVD audio and music doesn't sound nearly as good as through a stereo system, but at least the speakers aren't a complete disgrace.

The keyboard is first rate. It's easy to find your way around the keyboard, and typing is comfortable. IBM doesn't place a WINDOWS key on its keyboard, but the Keyboard Customization Utility lets you choose a specific key to use as a WINDOWS key. Like previous T Series models, the T40 includes both a traditional TrackPoint and a touchpad.

Performance. Despite its lower clock speed, the Pentium-M manages to hold its own. Our system managed a 158 Performance Rating in MobileMark 2002. For a comparison, IBM's ThinkPad R40 and HP's Presario 2810, both with a 2.2GHz P4-M, managed a 150 and 138 Performance Rating, respectively.

The real benefits of the PM, however, become apparent when you look at its battery life. Our T40 model posted a 286-minute Battery Life Rating. The 2.2GHz P4-M ThinkPad R40 and Presario 2810 posted 164 and 163 ratings, respectively. Some of that score is due to the 9-cell lithium-ion battery included with this particular T40 model. The more conventional 6-cell battery in a T40 still manages an impressive 201 minutes.

The T40's PCMark 2002 scores were also strong, scoring a 5,107 CPU Rating, just less than scores 2.2GHz P4-M systems posted. The 4,217 Memory Score and 457 HDD Scores are also competitive.

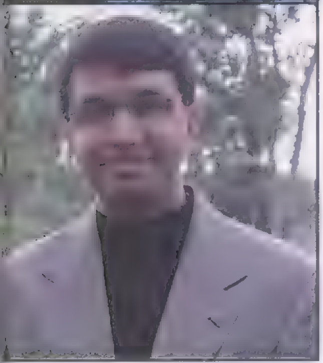
Final word. The strong-performing T40 seems especially suited to those who make their living on the road but don't want to compromise performance for portability. ▲

by Chad Denton

CPU Ranking: 0 = Absolutely Worthless 2.5 = Absolutely Average 5 = Absolutely Perfect

by Anand Lal Shimpi

Coming Intel & ATI Upgrades



Anand Lal Shimpi has turned a fledgling personal page on GeoCities.com into one of the world's most visited and trusted PC hardware sites. Anand started his site in 1997 at just 14 years old and has since been featured in USA Today, *CBS' 48 Hours and* Fortune. *His site—www.anandtech.com—receives more than 55 million page views and is read by more than 2 million readers per month.*

Two topics I've touched on this year have been the road maps of both ATI and Intel—from a distance, very unrelated companies. I hope you're not looking for me to draw some sort of parallel between the two, because none exists; it's just that both companies have made major product releases in the past month that are equally worthy of discussion.

First, we have ATI. Last month, I talked about the Radeon 9800 Pro and briefly mentioned ATI's first 0.13-micron GPU, the RV350. After more than a month, ATI finally released samples for benchmarking purposes and I was able to spend quite a bit of time with the Radeon 9600 Pro, the fastest incarnation of the RV350 core. From my previous column, you'll remember that the Radeon 9600 Pro features a 400MHz core clock and a 300MHz DDR memory clock. The RV350 core features four rendering pipelines and a 128-bit memory bus, giving the Radeon 9600 Pro a higher fillrate than the NVIDIA GeForce FX 5600 Ultra, but less memory bandwidth with only 9.6GBps (versus 11.2GBps on the 5600 Ultra).

The fill rate advantage (courtesy of the higher core clock speed) comes in handy for the Radeon 9600 Pro at almost all resolutions below 1,600 x 1,200. Performance in games like Unreal Tournament 2003 and Splinter Cell is better on the Radeon 9600 Pro than on the FX 5600 Ultra, but not significantly. Where ATI truly wins out is the fact that its anti-aliasing and anisotropic filtering image quality is noticeably better than NVIDIA's, which at the same price makes the Radeon 9600 Pro a better buy than the FX 5600 Ultra. NVIDIA is planning on updating the drivers on its FX line in the next month, which could change the performance and image quality of the 5600 Ultra considerably, so keep on the lookout for that.

> **. . . both of these newcomers are clearly outperformed by the 6-month-old Radeon 9500 Pro.**

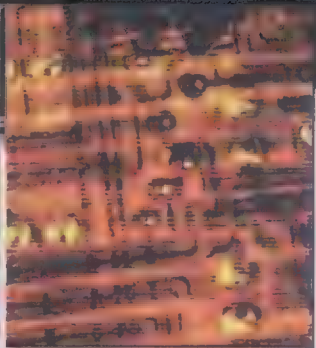
What's interesting to note about the Radeon 9600 Pro and the GeForce FX 5600 Ultra is that both of these newcomers are clearly outperformed by the 6-month-old Radeon 9500 Pro. Because the Radeon 9500 Pro is actually a lower-clocked Radeon 9700 Pro with a 128-bit memory interface, its performance is significantly higher than either of these new contenders. The reason ATI stopped making the Radeon 9500 Pro was simple: The card is just too expensive to produce, but at the time it served ATI's purpose of beginning to eat into NVIDIA's mainstream market share. The bottom line is that if you can get a Radeon 9500 Pro before they're out of stock everywhere, it's probably your best bet in this price range.

Next, we've finally seen the launch of Intel's highly anticipated Canterwood chipset, publicly known as the 875P. The 875P is quite possibly the most feature-filled Intel chipset ever launched. Not only does the chipset support 800MHz FSB CPUs and Hyper-Threading, but it also introduces a dual-channel DDR400 memory bus. Intel also introduced a new bus with the 875P, known as its CSA (Communications Streaming Architecture) bus. The CSA bus stems from the Memory Controller Hub (the thing that acts as a traffic intersection among the CPU, memory, and AGP graphics card) and interfaces to an optional Gigabit Ethernet controller. This bus offers 2Gbps of bandwidth, meaning that Gigabit Ethernet can now operate in full-duplex mode (1Gbps each direction) without being bandwidth-constrained. Prior to the introduction of CSA, Gigabit Ethernet controllers were installed in PCI bus slots, which only offer 1Gbps of bandwidth to share among all PCI devices—obviously not the best solution for high-performance Gigabit Ethernet.

The 875P also comes equipped with a brand-new I/O Controller Hub, ICH5. The new and improved part of ICH5 comes in the native support for two Serial ATA devices, as well as a total of eight USB 2.0 ports. A revision of the ICH5 chip, known as ICH5R, adds RAID support to the controller, offering RAID-0 support initially but, after an eventual BIOS/driver upgrade, will support RAID-1, as well.

Although there are new high-end GPUs coming on the horizon, the chipset market isn't going to see anything as dramatic as 875P (and the mainstream version, 865PE) for quite some time. As promised, these companies are delivering the upgrades we've been waiting for; let's see if they're enough to keep us interested for a while. Personally, I'm already waiting for something new. ■

Cast your feedback to Anand@cpumag.com.



by Alex "Sharky" Ross

A Few Gaming Upgrades

Disrupting Reuters' newswire with a cheery Christmas greeting at age six, Alex "Sharky" Ross became an avid computer user/abuser, eventually founding popular hardware testing/review Web site SharkyExtreme.com. Exposing shoddy manufacturing practices and rubbish-spouting marketing weasels while championing innovative products, illuminating new technology, and pioneering real-world testing methods was just a front for playing with the best toys. The site acquired, he left in 2001. A London native and London School of Economics graduate, Alex currently swims in Silicon Valley.

With so much new and emerging technology in the wacky world of hardware, I figured it was time to tear up the old Sharky gaming PC box and start from scratch. You might call this column my current top picks or something like that, or just much ado about nothing when you're swimming in geeky hardware and tired of running benchmarks. Obviously money is no object here, as I'm just trying to get the best possible performance out of a PC because I want to play Unreal 2 with everything turned on (AA and AF) at 1,600 x 1,200. And one more thing: I'm sick and tired of hearing, using, and writing "best bang for the buck." I just want to go balls out and forget about the cost per every fps for a change. . . .

I want to play Unreal 2 with everything turned on.

Starting with the CPU and platform, I figured I'd go with Intel's P4 3.0C with HT. Yes, I know it's 66MHz slower than the 3.06, but I'll take the quad-pumped 200MHz (aka 800MHz) FSB over 133MHz (aka 533MHz), thank you very much. Next up would be a Canterwood-based (875P) mainboard. Kyle really likes Gigabyte's GA-8KNXP Ultra, and so do I. It has six memory slots, Ultra320 SCSI RAID, Serial SATA RAID, funky colors, and all kinds of stuff that some may or may not find useful. It's over the top as far as motherboards go and offers some great overclocking and memory tweaking functions. Four slots filled with 2GB of Corsair's XMS TwinX dual-channel DDR400 memory should just about cover any memory needs and then some.

Obviously I don't enjoy playing at 640 x 480 and putting the CPU to the test. The 3D graphics decision was a bit of a toughie because I'm just about to start playing around with NVIDIA's NV35. (See the review next month.) However, if going with what's available now as opposed to "in the future," I went with the other obvious choice: the ATI Radeon 9800 Pro, and only because the All-In-Wonder edition isn't ready yet (but watch this space). This choice really makes it possible to tax the graphics subsystem and turn on all the eye candy at high resolutions. Even in Unreal 2, frame rates weren't exactly zippy at 1,600 x 1,200 with 4XAA and 8XAF. Doom III hasn't even shown up yet, and it still seems like there's more room for improvement.

Obviously, a couple of Serial ATA hard drives are required. Two Seagate SATA 120GB drives, set up in a RAID 0 configuration, would go hand in hand with a system such as I described above. That's more than enough storage for UT2003, Unreal 2, Raven Shield, C&C Generals, Splinter Cell, Hitman 2 (yes, I am trying to concurrently work my way through these), and WinXP Pro with DX9, plus a plethora of drivers. There's even room enough for MP3s, and it's all rather safe, thanks to RAID.

As far as audio goes, I'm more than satisfied with the on-board Realtek ALC655 AC'97 audio codec chip (which provides six-channel audio) on the mainboard hooked up to a set of Klipsch 5.1 speakers, but for those of you who want something new and dedicated, feel free to go with Creative's Audigy 2. However, this is about gaming, and a set of Sennheiser headphones plugged in does the job for me, even if it doesn't wake up the entire neighborhood.

I won't tot up the actual cost, but my guess is it's as silly and overpriced as a Porsche Cayenne Turbo. Only you can't play UT2003 in one (well, unless you want to deck it out with a PS2), and you can on this machine. And if it's driving you want, then play Need For Speed Hot Pursuit 2 on your newly configured and hideously overpriced gaming PC courtesy of Sharky's recommendations that care not for bang for the buck this time around. Try it out, and not only will your gaming experience be all the better for it, but Windows will seem all the more effortless, and your spouse will love you all the more. Build it for them; I am. . . . ■

Email your spouse's complaints to sharky@cpumag.com, and I'll email you a get-out-of-jail-free card.

by Kyle Bennett

ABIT & Intel @ 1GHz

Kyle Bennett is editor-in-chief of HardOCP.com (hardocp.com), one of the largest and most outspoken PC-enthusiast sites on the Web. HardOCP.com is geared toward users with a passion for PCs and those who want to get cutting-edge performance from their systems. Beware, though, Kyle is known for his strong opinions and stating them in a no-nonsense manner while delivering some of the most in-depth reviews and PC hardware news on the 'Net.

By the time you read this, Canterwood boards will most likely be for sale on e-shelves all over the USA. They will deliver to you the much-anticipated 800MHz system bus for the Pentium 4. Canterwood will be known as the i875P, and the i875P parts are "speed binned." This means that the i875P, which is Intel's high-end performance desktop part, is culled from the rest of the chipsets and checked to see if it is capable of running faster speeds than the others. This is exciting in itself, but of course, the first thing we wanted to do when we got our hands on one was overclock it.

ABIT, long known for its support of the black e-arts, delivered to me its IC7-G mainboard. You most likely read the title of our little column and thought, "1GHz? Big deal. My mom has broken the 1GHz barrier." You may very well be correct, but has your mom broken the 1GHz mark on the frontside bus with a desktop PC that anyone can purchase? We opened up our ABIT box and installed our 3GHz Pentium 4 that uses the 800MHz, and off we went.

> **Increasing the Pentium 4's bus from 800MHz to 1GHz gave us nothing on the gaming front . . .**

Because space is limited here, I'll cut to the chase. We installed one of our best heatsinks, the Thermalright SLK-900U, and a high CFM fan from Plycon.com and immediately went for the 250MHz FSB (x 4 for Intel's quad-pumped bus) and 250MHz DDR bus. Our CPU is unlocked, so we could set the multiplier at 12, giving us 12*250MHz, equaling our stock 3GHz clock. We could POST, but the system wouldn't boot WinXP. We worked with this for some time to no avail.

We then went to an unlocked 2.8GHz 533MHz bus CPU and used the same exact setup. To my chagrin, it POSTed and loaded WinXP at 1GHz FSB with the memory bus running at a synchronous 1GHz. Without a doubt, ABIT delivered to us the first true and stable "giga system" that we've seen. (Later, we learned that our 3GHz-800 CPU was the bottleneck, as some quick Koolance watercooling allowed us to run our sought-after speeds.)

Of course, now that we had our CPUs running very stably at 1GHz FSB, we decided to run some benchmarks. What we found was pretty amazing news, as far as the world of CPUs go. We saw some nice jumps in scores moving from 3GHz-533 to 3GHz-800, as we expected. What we saw going from 3GHz-800 to 3GHz-1,000 wasn't expected, which was basically nothing. Nada. Zilch. Increasing the Pentium 4's bus from 800MHz to 1GHz gave us nothing on the gaming front, and this is traditionally where large increases have been seen from FSB overclocking.

Now our experience on the business and content-creation applications benchmarks fared a bit differently. We did see increases from 533MHz to 800MHz, and we also saw some benefits from 800MHz to 1GHz FSB. Our theory is that our Winstone benchmarks run enough apps simultaneously to actually utilize the wider bus while our single-gaming benchmarks didn't.

We gamers have been seeking higher frontside buses for years now, knowing that combining that with CPU clock OCing delivers the best performance. It looks as though Intel may have very well claimed one of the current enthusiast Holy Grails. The new Pentium 4s at 800MHz FSB may have no real reason to push the bus beyond that point. Has Intel widened the FSB to the point that it has outstripped what software can utilize it? After a couple of weeks of testing, our gaming benchmarks show exactly that.

Now for the irony: FSB OCing is the only way to bump up the Intel CPU clock. So of course, we'll all be doing it anyway, and the ABIT IC7-G mainboard looks to be a very solid tool for making that happen. We've suggested for months that folks wait for this chipset to upgrade, and there's no doubt it delivers. Just wait for those 800MHz FSB CPUs we talked about last month. We're hoping the 2.4GHz and 2.6GHz models that will be less expensive will of course be good OCers. With that you will be able to build a system that will truly fit the profile of "killer rig." For more details, check out www.hardocp.com/article.html?art=NDU5. ■

Talk with Kyle at kyle@cpumag.com.

Swappin' Parts

CINDI's Black Screen Of Death

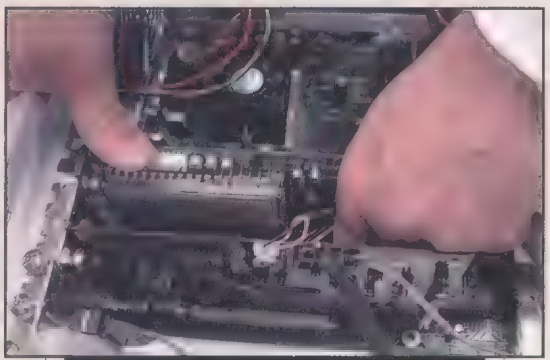
Each month in "Swappin' Parts," a Computer Power User *writer upgrades one out-of-date component in our test machine, CINDI (Computer In Need of Drastic Improvement). Last month, we added a big, fat 20-inch HP flat-panel display and several new input devices, including a Logitech keyboard and wireless mouse. This month, we're adding a video-editing program from Pinnacle Systems, a FireWire card, and a TV tuner with hardware MPEG encoder/decoder.*

CINDI's been begging us lately to buy her a new Canterwood motherboard and Intel CPU. I explained to *CPU's* silicon sweetie that the Canterwood just isn't available yet, so she'll have to be a good girl and wait a little longer.

CINDI really doesn't have a lot to complain about, though. Sure, she still needs a lot of upgrades to transform her from "Cinderella hausfrau" to "Cinderella glass slippers," but we've made good progress. I put her in a new Cooler Master case just a few months ago, and the Logitech speakers we gave her sure sound nice, not to mention the pricey flat-panel display I bought for her just last month. As of this article, CINDI's sweet-talked more than $3,000 Benjamins out of *CPU's* hip pocket, yet she still wants more. Money does *not* grow on trees, young lady! She didn't like that answer, though, so I tried to pacify her with a little television instead. Hey, it works for the kids. Unfortunately, it didn't work as well for me.

Tune In, CINDI

I decided to buy Hauppauge's WinTV PVR 350 TV tuner (www.hauppauge.com) because it has PVR functionality and a built-in MPEG encoder/decoder. CINDI isn't a speedy PC, so she needs a little help working with large MPEG files.



The WinTV PVR 350 card was a tight fit, but we made it work

125 channels and nothing's on

Pinnacle Studio 8

I also decided to buy Pinnacle Systems' Pinnacle Studio 8 DV (www.pinnaclesys.com), an excellent video-editing program that includes a FireWire card. I found both items at Amazon.com ($179.99 for the WinTV PVR 350; $95.99 for Pinnacle Studio 8).

CINDI should have been a multimedia darling once I installed these components. She already had the great sound system and the Big Screen. I was hoping she'd be ready for the movies and television once this upgrade was finished, but she just barely passed the audition.

The Hauppauge WinTV PVR 350's minimum system requirements include a 500MHz Pentium II CPU, VGA card that supports DirectDraw, and any of the Windows 98SE/Me/2000/XP OSes. Pinnacle Studio 8's minimum system requirements are nearly identical to the WinTV PVR 350's: a 500MHz Pentium CPU, 128MB of RAM, a DirectDraw-compatible video card, and any of the OSes previously listed. CINDI has a 600MHz Celeron CPU, 128MB of RAM, an Intel 82810 integrated video chip, and the dreaded WinMe sometimes-operating system. CINDI just barely made the cut for these products, although her video chip leaves a *lot* to be desired. Actually, I can say that about a lot of CINDI's features, but, of course, that's the whole point of this exercise.

I had two PCI cards to install this month: the Hauppauge TV tuner card and the Pinnacle Systems FireWire card. CINDI has just enough room to accommodate them in her eBlechines motherboard, with a grand total of three PCI slots, one of which is occupied by a SoundBlaster Audigy 2 sound card. I tried to install the Hauppauge card first in the middle slot, but for some reason, it didn't quite fit there. I popped the FireWire card into the middle slot instead with no resistance. I managed to slip the WinTV PVR 350 into the top PCI slot, although it was still a tight fit. The WinTV PVR 350 includes all kinds of connections and cables, such as an FM wire antenna, an S-Video cable, and composite cables for an external video source, but initially I simply connected the card to a cable TV line, which was easy enough.

I restarted CINDI and installed the software for the WinTV PVR 350. The software installation includes DirectX 8.1, a light (read, "Special Edition") version of Ulead's DVD MovieFactory, Adobe Acrobat 5, and some other utilities, in addition to the WinTV PVR 350's drivers and WinTV 2000 program. The software installation went without incident—until I tried to actually run WinTV 2000. At first, the program would simply crash or lock up, usually when I tried to scan cable channels, which is the first order of business when you start WinTV 2000 initially. Sometimes, the program would lock up during startup. Other times, it would hang after completing a full-channel scan.

I went to Hauppauge's Web site to find a patch or update for WinTV 2000 or the WinTV PVR 350. I found several scattered about Hauppauge's Web site in different tech support and product support areas, but with no clear indication as to which patches were the most recent. I decided to begin with a hardware update first, so I downloaded what appeared to be the most recent patch for the WinTV PVR 350 board and installed it. That seemed to help a little, as WinTV 2000 quit crashing every time I looked at it. I was able to run a full-channel scan without the program locking up, but when I tried to watch a channel, the screen was black. No video, no sound.

I went back to the Hauppauge Web site and looked for software patches and perhaps some insight as to what may be causing this particular problem. I found an FAQ in a troubleshooting section that included some "black screen" information. "Jackpot!" I thought. "This should clear everything up." The FAQ mentioned that a conflict with WinDVD software or other DVD decoders are usually the cause of black screens in WinTV 2000. The FAQ recommended uninstalling all DVD decoding software on the PC. The FAQ also listed another workaround and a couple of links to yet more driver and application patches. I downloaded the patches for CINDI, confident that she'd be watching Tom Brokaw by dinnertime.

> I'm not precisely sure why CINDI is being so petulant. Maybe she doesn't like television. Maybe it's because she's still an eMachines system at heart and using WinMe to boot.

CINDI had one DVD program, CinePlayer, which I uninstalled. I then installed the patches and restarted the system. The tech support information said that I had to disable WinTV 2000's Overlay mode and use Force Primary instead. The program includes a Primary utility that controls those settings, so I opened it and selected Force Primary. I then opened WinTV 2000 and scanned the channels again. The program detected the cable channels, but as before, all I saw was a black screen.

So I went back to the Hauppauge Web site yet again to make sure I didn't miss a step and that I had all the downloads I needed. I did, so I decided to start over. I completely uninstalled all of the WinTV PVR 350 applications and drivers, restarted the system (again!), and reinstalled the drivers and applications. This time, I installed the patches before I opened the program. WinTV PVR 350 didn't crash or lock up this time, but I still got a black screen.

Once An eMachine, Always An eMachine?

I'm not precisely sure why CINDI is being so petulant. Maybe she doesn't like television. Maybe it's because she's still an eMachines system at heart and using WinMe to boot. My best guess is that the integrated video chip is causing the problem. That will be remedied soon when we get a Canterwood, so we'll give the WinTV 2000 application a try again then. Meanwhile, I still had Pinnacle Studio 8 to install.

Studio 8 was a lot less hassle to get working than WinTV 2000. I installed the application from the two-disc set and started the program. It opened with no trouble, although the program ran pretty slowly. That's not unexpected given CINDI's old-school CPU, RAM, and video chip, but at least she could run the program. Having said that, I would hate to have to edit a feature film on this system, as it would take forever. CINDI is going to need much faster components before she will be a practical solution for video editing.

Which brings us to next month's upgrade. If all goes well, by this time next month we will have outfitted CINDI with a new Canterwood mobo, not to mention a 3+GHz Intel CPU and a fistful of fast RAM. We are also going to upgrade CINDI to WinXP because, frankly, we are tired of dealing with her WinMe.

All of this is assuming we can find a good Canterwood motherboard before our next deadline, which may or may not happen. If it doesn't, we'll give CINDI a month of summer vacation and return the following issue with a Canterwood in hand. Keep your fingers crossed. We know we will.

by Michael Sweet

X-ray Vision:

The Memory Standard Geared Toward Graphics

One of the earliest life lessons you probably learned was that working together on a project yielded faster and better results than infighting ever could. Although you may have learned this in the neighborhood sandbox, the lesson just never sank in for some people. Take the developers of DDR2, for example. Infighting and disagreements among developers over the standard for this updated memory technology have delayed its implementation in large quantities.

And now DDR2 may have lost its chance. A new memory technology, called GDDR3, is poised to potentially leap past DDR2. Developers of GDDR3 have followed another important life lesson—learn from the mistakes of others—to avoid the problems that have plagued DDR2's implementation. GDDR3's developers are working together to create an open standard, letting them bring their technology to the market more quickly.

Graphics Take Precedence

The use of DDR in graphics cards over the past four years has greatly accelerated improvements in graphics, especially for gaming software. Still, the memory chips on graphics cards have typically been the greatest drag on graphics card performance and speed. For that reason, graphics card developers have been early adopters of fast, cutting-edge memory technologies. GDDR3 will be the first DRAM designed specifically for a market before an industry standard is available, and developers hope GDDR3 can significantly lessen the drag in performance that memory chips have caused with graphics cards.

The official name for GDDR3 is Graphics Double-Data Rate 3 SDRAM. ATI and Micron are leading the charge on GDDR3, along with Infineon, Elpida, and Hynix. Although GDDR3 is based on DDR technology, developers configured GDDR3 for use on graphics cards alone from the beginning. This differs from DDR and DDR2 technology, which initially appeared as desktop computer memory; developers didn't adjust the technology for use on graphics cards until later. GDDR3 is the third generation of DDR memory technology. (The "3" in GDDR3 stands for the third generation; it doesn't mean GDDR3 is always three times as fast as DDR.)

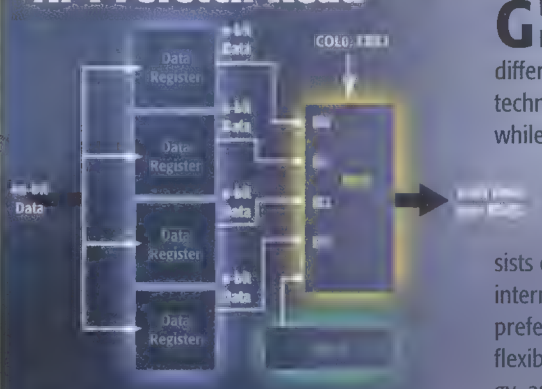
DDR memory is twice as fast as traditional memory because it moves one bit of data on both the rising and falling edges of each clock cycle, effectively doubling the transfer rate. (For example, 100MHz DDR would have an effective 200MHz clock.) The transfer rate of DDR is calculated by multiplying the effective clock frequency of the memory by the bus width.

DDR, currently used on most graphics cards, tops out at an (effective) clock speed of 400MHz. DDR2, appearing in a limited capacity in current graphics cards, offers an initial effective clock speed of 350MHz and is expected to top out at around 600MHz. GDDR3 should initially provide effective memory clocks at about 500MHz, with future speeds up to 800MHz.

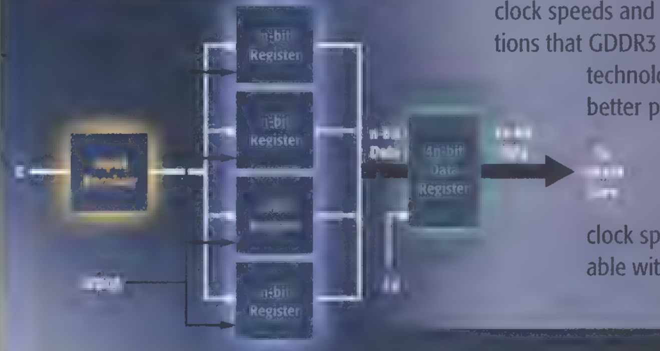
GDDR3's Improvements

GDDR3 should consume about one half the power DDR2 requires and should run about 50% faster than DDR2. For example, Micron is developing GDDR3

4n-Prefetch Read



4n-Prefetch Write



GDDR3's architecture is similar to DDR memory, but one of the major differences involves its use of prefetch technology. DDR uses 2n-prefetch, while GDDR3 uses 4n-prefetch. The 4n-prefetch transfers four data bits every two clock cycles. A read or write access under GDDR3 consists of a 4-bit wide data transfer at the internal DRAM core. By using 4n-prefetch, GDDR3 sacrifices some of the flexibility found in 2n-prefetch technology, and it can lead to less performance per clock speed. However, 4n-prefetch technology is essential for the high clock speeds and uninterruptible operations that GDDR3 requires. 2n-prefetch technology may offer slightly better performance versus 4n-prefetch, but 2n-prefetch cannot match the maximum clock speeds that are available with 4n-prefetch.

SOURCE: MICRON

chips manufactured with 0.11-micron technology that will run at an effective 700MHz clock.

Because DDR and DDR2 are desktop memory technologies, they have some overhead and capabilities that aren't necessary for graphics processing alone, which hinders their performance on graphics cards. For example, GDDR3 employs greater point-to-point capabilities with its I/O mechanisms than does DDR, which lets GDDR3 take better advantage of the point-to-point connection between the graphics memory and the graphics controller. GDDR3 uses an open-drain I/O technique, rather than the push-pull I/O technique used in PC memory, to further simplify graphics card design.

GDDR3 emphasizes high-speed signaling, as well, which makes it ideal for graphics processing. Developers protect the signal integrity for GDDR3 by using on-die termination, which also eliminates voltage and temperature variations.

Leapfrog

Some industry analysts call GDDR3 an upgrade and successor to DDR2. But there's one problem with that line of thinking: DDR2 isn't yet available to consumers in large volumes. Widespread development and adoption of DDR2 currently remains in limbo as three companies—Hynix, Samsung, and Winbond—are offering their own versions of DDR2. Other memory manufacturers, including Micron and Infineon, have declined to work on DDR2, focusing their efforts on GDDR3.

The market fragmentation has hindered adoption of DDR2. Availability of DDR2 chips for graphics cards has remained low, and prices for the technology have remained high, limiting use of DDR2 to high-end graphics cards. DDR2 appears in some NVIDIA GeForce FX graphics cards. ATI expects to incorporate DDR2 in its Radeon 9800 Pro card, which was scheduled to ship in the second quarter of 2003.

Industry analysts hope creation of a JEDEC standard for DDR2, scheduled to occur this summer, will improve the prospects for DDR2 by stabilizing the market and lowering prices for the memory. Most graphics card manufacturers have said they won't begin using DDR2 in significant quantities until its prices drop. The JEDEC standard is attempting to mesh the top features in the three versions of DDR2 currently available without favoring any particular brand.

Supporters of GDDR3 are choosing to push forward without a JEDEC standard in place because the lengthy process that JEDEC must go through to create a standard would greatly inhibit the product cycle for GDDR3 graphics cards. Although computer system memory can have a product life cycle of two to three years, graphics memory typically works on a product cycle of nine to 12 months. (JEDEC is working on a standard for DDR3, which will be memory designed for the PC.)

GDDR3 developers have agreed to operate under an open standard outside of JEDEC that will be available to all companies, including ATI's main competitor in graphics card development, NVIDIA. (But there are conflicting reports about whether NVIDIA will support and make use of GDDR3 as it's initially configured.) Developers think that by bringing GDDR3 to market through graphics cards in quick order, the new memory technology may eventually appear in other applications that require high-speed memory, such as networking and consumer electronics devices.

With ATI claiming GDDR3 will be available sometime this year, it might make DDR2's usable lifespan extremely short, with or without adoption of an industry standard. GDDR3 developers claim their ability to agree on the development of the technology has let them spend the majority of their time implementing the technology. DDR2's developers, who have spent the majority of their time wrangling over the standard, might end up learning another life lesson the hard way: You snooze, you lose. **CPU**

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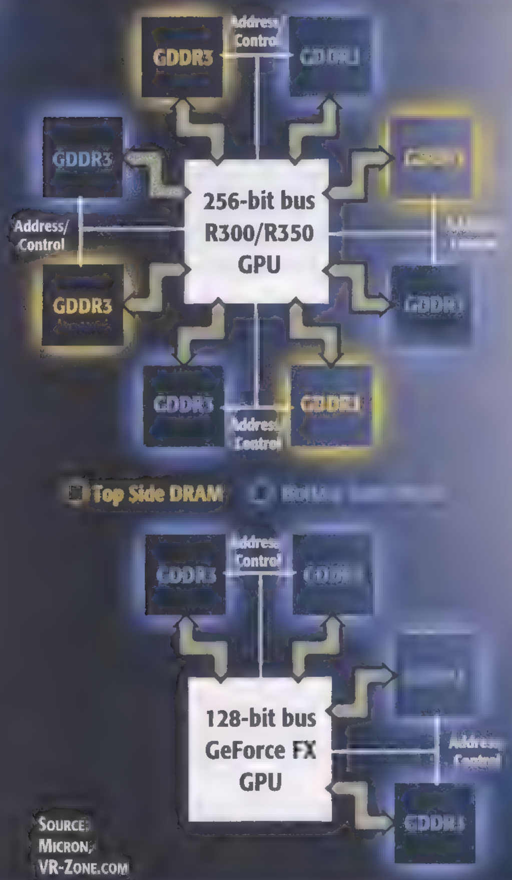
by Kyle Schurman

For more on GDDR3, subscribers can go to www.cpumag.com/cpujun03/gddr3.



Source: Micron, VR-Zone.com

GDDR3 In Action

These diagrams show how GDDR3 memory can be implemented with both a 256-bit bus and a 128-bit bus GPU.

In the 256-bit example of an ATI R300/R350-based graphics processor (top graphic), the eight memory areas each have access to 32 bits of bidirectional bus capacity through a data input/output channel (represented by the yellow arrows).

In the 128-bit example of a GeForce FX graphics processor (bottom graphic), the four memory areas each have access to 32 bits of bidirectional bus capacity through a data input/output channel (represented by the yellow arrows).

During power-up in both types of GDDR3 buses, the on-die termination is set to maintain the integrity of the data input/output channel by eliminating voltage and temperature variations. Dual-load address and control lines are set during power-up, too.

Graphics & Design: Sonja Warner & Jason Codr

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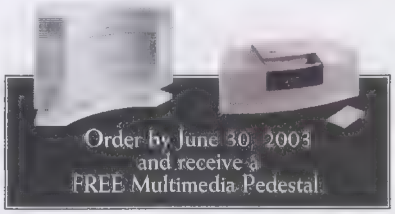

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PCI Express

The Next Big Thing To Hit Your PC

Why should you believe the hype surrounding PCI Express? Because it truly has the potential to be one of those "can't-live-without-it" technologies. As technology continues to improve, it's essential that the basic PC architecture keeps up with the new technology. Such things as increasing processor speeds, ever-more powerful video cards, and Gigabit Ethernet are great, but if archaic bus architecture slows them down, they're not much use to anyone.

PCI Express, which was originally dubbed 3GIO, is the next-gen bus architecture that has emerged to take the place of the PCI bus. (You can read our coverage of 3GIO technology on page 48 of the June 2002 *CPU*, as well as additional coverage of PCI Express in Mike Magee's Shavings From The Rumour Mill column on page 100 of the May 2003 *CPU*.) This bus connects various devices and peripherals to each other and to the main system bus inside the PC. This extensive overhaul in the design of the desktop PC is hyped as being one of the biggest developments for the PC in years.

So what's new with the technology since our coverage of it when it was called 3GIO? Not much, actually. The advisory group overseeing PCI Express, the PCI-SIG, has remained busy, though, focusing on implementing PCI Express in the marketplace and in shaping the future of the technology. The industry is only now getting closer to including PCI Express in consumer products; here's a look at what all of this means to you.

From Parallel To Serial

PCI Express is a serial I/O technology, which gives it a higher bandwidth than parallel I/O buses, such as PCI and PCI-X. Serial buses aren't restricted by the same synchronization requirements of parallel buses, allowing for faster clock speeds. In a parallel bus, data typically must travel through the links that make up the bus in a parallel fashion, and each link must be the same length, causing headaches for motherboard designers. With a serial bus, data can travel without parallel delivery, and the links can vary in length, providing flexibility in motherboard design.

PCI Express offers a data-transmission speed of 2.5Gbps per direction in each serial link. The technology makes use of bidirectional data transmission within each serial link, meaning each serial link has a total bandwidth of 5Gbps (although you'll almost always see the speed measured in Gbps per direction). And PCI Express is scalable, so developers can choose to use one, two, four, eight, 12, 16, or 32 serial links within a lane. (The collection of serial links within a single implementation of PCI Express is called a lane.) PCI Express has a maximum data-transmission speed of 160Gbps per lane, when 32 bidirectional serial links are in use. Although no one has immediate plans for a product with 32 serial links, PCI-SIG chairman Tony Pierce says graphics developers are currently working on products that use 16 serial links in one lane. Most other products will initially appear with one or two serial links per lane.

Apples and oranges. The PCI-SIG says accurately comparing current bus technologies PCI and PCI-X with PCI Express makes comparing apples and oranges a piece of cake: There are significant differences in architecture between the bus technologies. However, those involved with the technologies estimate PCI Express can move about 60 times more data than PCI and about 14 times more data than PCI-X,

Clearing Up Bandwidth Confusion

If you've read anything about PCI Express, you've probably seen several claims of speed and bandwidth, very few of which seem to relate to each other. However, PCI-SIG chairman Tony Pierce says the most accurate measurement of the bandwidth of PCI Express is its ability to move 2.5Gbps of data per direction in each serial link.

Some analysts discuss an effective speed for PCI Express of 2Gbps per direction in each serial link. Those analysts are discounting the portion of the serial link that the 8b/10b encoding occupies. The 8b/10b encoding occupies 20% of the data-transmission capabilities, leaving 80% as an effective measurement of data transmission. (The inclusion of 8b/10b encoding is common in high-speed data-transmission components, such as Gigabit Ethernet. It allows for high frequencies and flexibility in routing, and it's embedded in data packets.) Pierce says as 8b/10b encoding becomes more routinely used, fewer and fewer analysts will calculate an "effective" speed for data-transmission technologies.

You also might see measurements of 100MBps or 125MBps of data transmission per signal pin for PCI Express. This is because some analysts have attempted to convert the data-transmission rates for PCI Express into data rates per signal pin in an effort to compare the speeds of the technologies. Although data measurements per signal pin often appear for PCI and PCI-X components, Pierce says they aren't reflective of the true data-transmission rates for PCI Express because its architecture is so different from the other technologies. ▲

under particular configurations. Some who prefer PCI-X technology say PCI Express doesn't significantly outperform PCI-X yet, especially when used in servers. Most say future configurations of PCI Express will probably yield major improvements in performance over PCI-X, however.

Speed isn't the only benefit PCI Express promises. The high data-transmission speed of PCI Express will let developers reduce the pin counts required for making connections. With fewer signal pins, designers can make PCI Express boards smaller, cheaper, and less complex than PCI or PCI-X boards.

Standard Implementation

The PCI-SIG (Peripheral Component Interconnect-Special Interest Group) developed PCI Express as an open specification, designed to work throughout the communications and computing industries. PCI Express is a flexible and scalable standard, letting it appear in several types of hardware in several different types of market segments.

Once PCI Express gains a strong foothold in the PC market, its impact should be dramatic. Before PCI Express can enjoy widespread success, though, it must pass a series of milestones. First, Intel plans to deliver PCI Express chips in the second half of this year. At the same time, Intel will ship PCI Express toolkits to hardware and software developers, hoping that computers that fully support PCI Express will appear in 2004. Intel also plans to release its Tejas microprocessor in 2004,

The PCI Express Advantage

PCI Express will provide some impressive improvements to bus architectures, but it isn't designed to replace every type of bus. The diagram on the top shows how PCI Express could be implemented in a computer system (the PCI Express buses are shown in red); the diagram on the bottom shows how buses in a current system are commonly implemented.

1 PCI CONVENTIONAL

Although the PCI-SIG plans to continue supporting PCI and PCI-X, the PCI Express standard will probably replace the PCI bus and the PCI-X bus in some systems. In some instances, a PCI or PCI-X device will connect to PCI Express through a PCI or PCI-X bridge.

2 SERIAL ATA

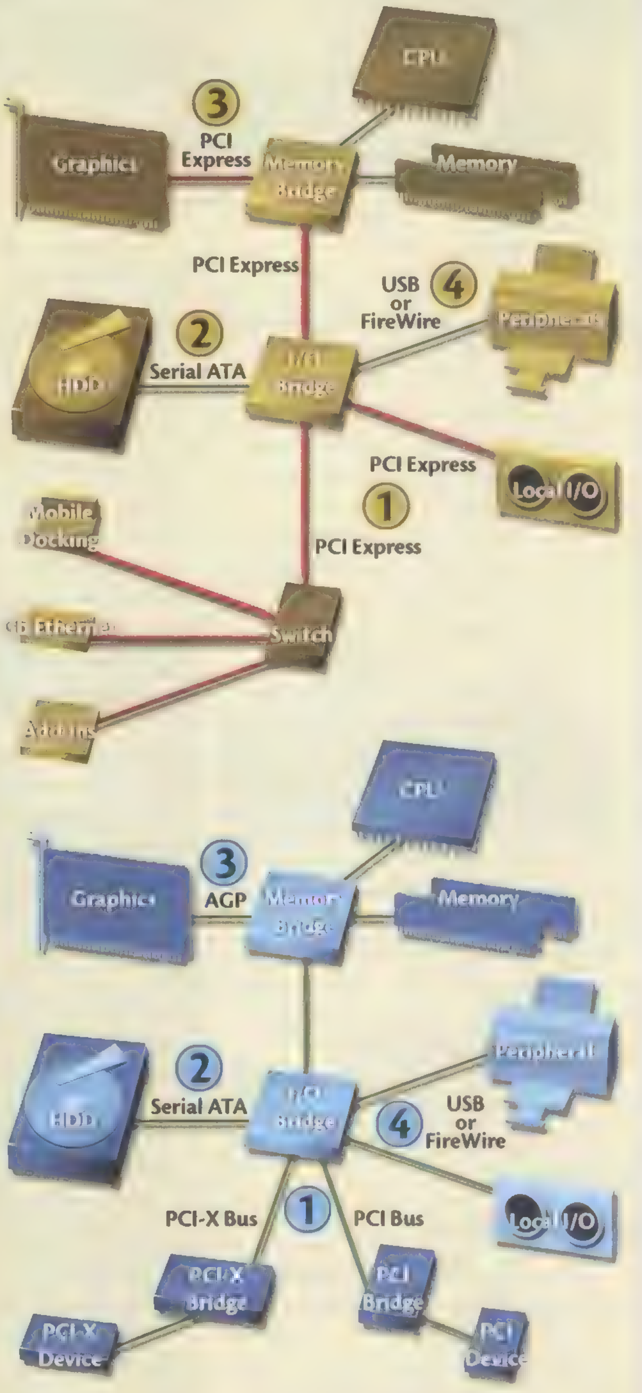
PCI Express and Serial ATA are intended to be complementary technologies, in part because Serial ATA is dedicated to internal storage devices, while PCI Express attempts to be more flexible. The two technologies are compatible.

3 AGP

The PCI-SIG does expect PCI Express to replace AGP 8X buses at some point. PCI Express initially will provide twice the bandwidth of AGP 8X, making it ideal for the high-bandwidth needs of graphics applications. PCI Express can support multiple graphics I/O devices in a single system, too, giving it an additional advantage over AGP 8X.

4 PCI EXPRESS

PCI Express will compete directly with, as well as support, FireWire, USB, and other I/O technologies for peripherals. Developers might choose to use a PCI Express bus to provide a direct link to these types of I/O technologies, for example.



Sources: PCI-SIG, Intel

and it will support PCI Express. A few developers, such as Texas Instruments, have already pledged to begin creating PCI Express components by early 2004.

However, industry analysts say the overall industry migration to the serial technology in PCI Express will probably still take until at least 2005 or 2006, in part because consumers and corporate customers will have to invest in quite a bit of new hardware to take full advantage of the new technology. PCI Express represents a radical departure from PCI and PCI-X, and its connector won't work with PCI and PCI-X slots. PCI Express achieves backward compatibility with PCI and PCI-X using software emulation, which cannot provide most of the speed improvements you'd find if using only PCI Express hardware and software. Swapping out all PCI and PCI-X components will require time and money.

As for how PCI Express will get along with today's popular bus technologies, in certain circumstances, PCI Express will compete directly with RapidIO's serial system interconnect spec. But PCI Express will not compete with HyperTransport, the onboard, chip-to-chip bus. This technology doesn't match the features of PCI Express. Instead, the two technologies will complement each other, especially if developers decide to bridge a systems HyperTransport bus to the PCI Express bus. For more on how PCI Express will affect current bus technology, see the "The PCI Express Advantage" graphic.

Serving up skepticism. Server manufacturers are giving the analysts' predictions some credence: Many of them plan to stick with PCI-X 2 as a bus technology in servers for now. Only Dell currently has pledged to make servers in the near future featuring PCI Express. Also, ServerWorks, a company that is the leading supplier of chipsets for servers featuring Intel processors, has been reluctant to throw full support behind PCI Express immediately, which almost certainly will delay the implementation of the technology in the server market.

Intel's aggressive plans to implement new technologies, such as PCI Express, have become standard fare for the company. But Intel's recent track record of success with such technologies has encountered a few bumps, which is further complicating the migration to PCI Express in the eyes of server manufacturers. Intel initially supported Rambus memory, which has slipped behind DDR memory in implementation. Intel also supported InfiniBand as a next-gen I/O bus before abandoning the technology in favor of PCI Express. Such false leads have made some server manufacturers nervous about investing wholeheartedly in a new Intel-favored technology.

Finally, analysts say PCI-X, using a common 184-pin connector, can achieve a maximum data-transmission speed of 4.3Gbps under currently available PCI-X frequencies. Although that speed doesn't compare with the maximum of 160Gbps available with potential configurations of PCI Express, PCI-X's top speed will be more than fast enough for many applications, and it doesn't require a system overhaul, as does PCI Express.

Tweaking For The Future

Despite these potential problems, the PCI-SIG is already working on ideas for the future. Because of its support for multiple data lanes and various data-transfer speeds, PCI Express technology offers quite a bit of scalability for future applications. For example, the next generation of the architecture will probably offer data-transmission speeds of 5Gbps to 6.25Gbps per direction in each serial link, Pierce says. Some rumors have placed the maximum speed for PCI Express at 40Gbps, but Pierce says the PCI-SIG expects the standard will max out at no more than 10Gbps using current materials.

Further, a variation of PCI Express would let developers separate the microprocessor and memory from the hard drive by transmitting signals over a cable as long as 30 feet, rather than a bus. "This really opens the momentum for design," Pierce says. "The handcuffs are off. The rectangular, beige box—we can hope—is a thing of the past. The form factor can be whatever."

The PCI-SIG recently finished a specification for developing expansion cards that make use of a variant of PCI Express. The cards would provide FireWire and Gigabit Ethernet capabilities. And Intel says a future version of PCI Express may eventually replace the PC chipset southbridge, which gives various PC components access to the microprocessor.

Although the possibilities for the future of PCI Express are exciting, we're not greedy. We'll be happy with simply making use of the speed and flexibility of PCI Express inside the PC, whenever it arrives. Just don't hold your breath: It'll be at least a couple of years before consumers will easily find systems containing only hardware and software that is fully PCI Express-compatible, letting them realize the complete benefits of PCI Express. PCI Express may be worthy of its hype.

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by Kyle Schurman

For more on PCI Express, subscribers can go to www.cpumag.com/cpujun03/pciexpress.

PCI Express Specs

Here are some of the base specifications for PCI Express.

- Compatibility with PCI device driver models at the software level
- Point-to-point interconnects with between one and 32 dual-direction serial links that each offer 2.5Gbps per direction of data-transmission speed, providing dual-direction bandwidth possibilities up to 160Gbps
- Scalable bus widths from upstream to downstream
- Predictable low latency for applications that require isochronous data delivery
- Increased bandwidth per pin simplifies board design and reduces issues related to signal integrity
- Use of small connectors for space savings
- Native hot swap capabilities
- Native hot plug capabilities
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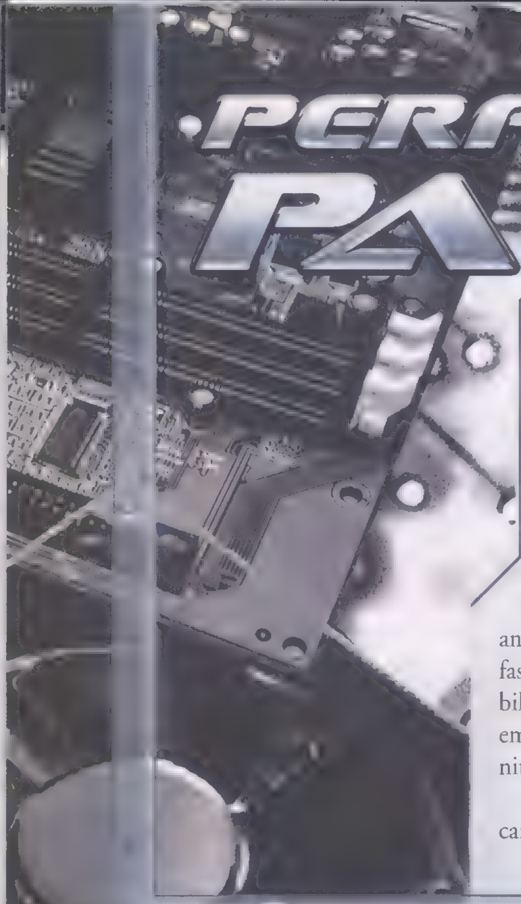
PERFORMANCE & PANACHE



An Introduction To PC Modding

There are those who can buy a car and own it for years, perfectly content with its performance and handling characteristics. Others will add a modified intake or an exhaust with a more aggressive rumble. Then there are those who see a car in its stock form as a platform for improvement. Take the Honda Civic, for example. Docile enough off the dealer's lot, Civics can be transformed into turbocharged beasts with built-up engines and fine-tuned suspensions. An entire culture has erupted in this pursuit of performance, but faster track times don't tell the whole story. "Go-fast" aftermarket parts often sacrifice reliability and void warranties, and so a brand-new aesthetic dimension of the car culture has emerged, where two-tiered wings, neon lights, and plastic molding enjoy popularity alongside nitrous oxide and slick racing tires.

It isn't hard to draw parallels between the community dedicated to modifying (modding) cars and the growing group of computer modders. Both have roots in performance, be it in the interest of horsepower or megahertz, and both boast tightly knit communities where the experienced take time to help enthusiastic newcomers. But whereas cars have come under the knife for decades, the computer modding scene has only taken off most notably over the past couple of years.

Most modders will concede that cooling was the catalyst for cutting their cases the first time. Gareth "Lord Pheaton" Powell of www.pheaton.com was experiencing heat problems with his AMD K6-2 processor back in 1998, so he added an Alpha heatsink and extra cooling fans. His heat problem persisted, unfortunately, and it wasn't until he cut an exhaust hole (referred to as a blowhole) in the top of his In Win case that the system ran stably. Modifications that facilitate enhanced cooling characteristics, such as Gareth's blowhole, naturally lend themselves to overclocking. Though Gareth sees the aesthetic, artistic side of modding as the most popular and fastest growing, there is still a faithful following of performance fiends willing to modify their systems solely for a few extra frames per second.

In The Name Of Functionality

Most performance modders have an unquenchable desire to push hardware as far as the laws of physics permit. Processors, video cards, and memory are the most commonly overclocked components, but a person can even soup up a Texas Instruments TI-85 graphing calculator by simply removing a capacitor. Kyle Bennett of HardOCP.com (and also a *CPU* columnist) recalls his first performance modding project: trying to get a 266MHz Celeron stable first at 400MHz and then at 448MHz. "With five case fans (including a blowhole) and one heatsink/fan combo, I was able to bring the system temperature down by 10°F." Cruising at 92 degrees, Kyle managed to stabilize his Celeron system.

Most performance modders get a 266MHz Celeron to run reliably at 448MHz (or a 1.6GHz Pentium 4 at 2GHz+, for that matter) with a combination of BIOS settings, meaning anyone with a flexible

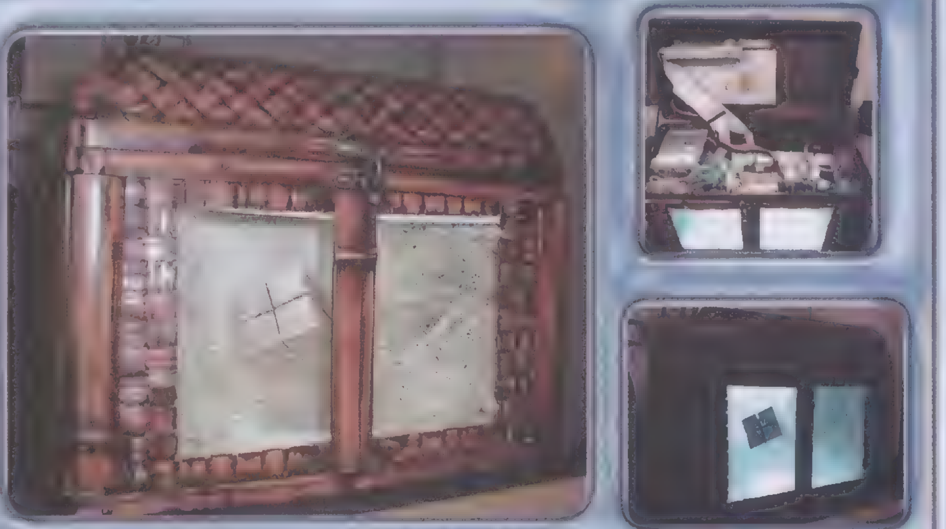
46 Making A Case For Cases
52 Don't Blow It
56 Be Cool & Quiet Down
60 Performance & Overclocking Mods
66 An Eye On Aesthetics

Graphics & Design by Andria Schultz & Carrie Benes

motherboard can try their hand at overclocking. The direct result, however, is greater heat output and, in many cases, diminished stability. Strategically positioned case fans, rounded cables, and larger heatsinks are all ancillary mods that are often able to stabilize an overclocked configuration suffering from heat-related problems. In short, performance modding necessitates minimizing heat. Modders often use additional fans to pull fresh air into a stuffy case or blow heated air away from sensitive components. Cables can be rearranged to promote better airflow, as 80-conductor IDE cables frequently perpetrate disarray in an unkempt case. Of course, heatsinks draw heat away from the processor. Most high-end units feature copper construction for expedient heat transfer.

Another common byproduct of performance modding is excess noise. Moving heat, especially from an overclocked system running beyond spec, requires high-output cooling fans, the most powerful of which spin around 5700rpm. Vantec's 80mm Tornado, for example, does a superb job of moving 80cfm (cubic feet per minute) of air, but it creates a nearly unbearable quantity (55.2dB) of noise pollution in the process. A new movement has consequently emerged from the idea that fast hardware is synonymous with loud, active cooling. Instead of employing fans, large heatsinks are used to dissipate heat over more surface area. Heat-pipe technology can be instrumental in the success of these designs. The fundamental purpose of a heat pipe is to quickly absorb heat in a condensation-evaporation cycle. For example, Shuttle's I.C.E. technology is flexible enough to handle an Athlon XP 3000+ in the confines of a small form-factor box a single 80mm fan cools. As PCs find their way into entertainment centers, these devices will undoubtedly become even more popular. But because they can become saturated with heat, silent cooling measures aren't particularly useful for aggressive overclocking.

Advancing past cutting exhaust holes in the side of a case with a Dremel rotary tool, more aggressive performance mods include watercooling kits and thermoelectric coolers. Both offer greater potential gains but could be complicated for the uninitiated. Thermo-electric modules create a lot of excess heat energy as they cool, and condensation around the CPU socket interface can



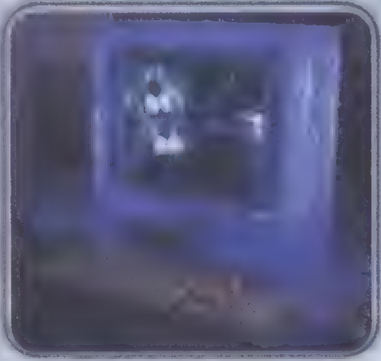
InvisiblePC

The Plexiglas window is an immensely popular mod because it showcases a system's innards. But instead of Plexiglas, Dean Liou chose to create an optical illusion within his InvisiblePC. A 2GHz Pentium 4 occupies the wicker case, but the window on the side shows a cube suspended inside, artfully achieved with electroluminescent lighting (www.beingseen.com) and mirrors.

PREMIER PC MODS

Frostbyte

Gareth Powell fashioned Frostbyte's case using clear casting resin, dyed to look like ice and textured with crumpled tinfoil. A 15-inch Sony LCD was integrated into the front, and a hinged door covers the back of the case. A 2.4GHz Pentium 4 on Intel's "Blue Mountain" i845PE motherboard powers the system. Frostbyte also features an MSI GeForce4 Ti 4400 and Maxtor's ATA/133 30GB half-height hard drive. The system didn't look quite right with an optical drive, so Gareth added an external USB 2.0 CD-RW drive.



Anemone

Johan Grundstrom began his project with a 1940s Bush DAC 90 tube radio. A Velleman K4300 Spectrum Analyzer kit mounted in casting resin was used in the spot that formerly housed the speaker. Anemone is powered by an 800MHz Celeron on Shuttle's FV-24, which works fine for MP3s. (After all, Anemone is an addition to Johan's home cinema setup.)

also become a problem. Watercooling is often regarded as a safer venture. However, it is imperative that the entire circuit is properly sealed for obvious reasons. One of the most extreme forms of performance modding is direct die cooling, where water is passed over an exposed processor die to quickly remove heat. The water is pumped through a large reservoir or a radiator, cooling it off, and the process begins anew. See the article on page 56 for more information on keeping your system cool without sacrificing quiet. Subscribers can also check out www.smartcomputing.com/cpumag/apr02/watercooling for CPU's April 2002 watercooling coverage.

Though processor overclocking receives the most attention, performance modders also focus on video cards and chipsets. High-resolution gaming primarily taxes the graphics subsystem, so additional frequency a modder can squeeze from the core or memory bus can have a measurable impact on frame rates. Mods range from simple heatsink/fan combinations to elaborate watercooling solutions, run in parallel with a CPU circuit. A person can also mod the north bridge on a motherboard to operate reliably at higher frontside bus speeds. See the article on page 60 for more information on these types of performance mods.

Not Just For Decoration

Pushing the envelope of processor technology with innovative cooling techniques is exciting in its own right. But the modding community is even more passionate about the amalgamation of performance and art. "Lord Pheaton" claims that modding isn't just a technical phenomenon; it's also aesthetic.

Any modification that serves to differentiate a case but doesn't necessarily enhance performance can be considered aesthetic. A custom paint job is a good place to start. Plexiglas windows are also popular, as they showcase flashy hardware. Neon lighting is another favorite, basic as it may be. In fact, several case manufacturers have already picked up on the popularity of these products, selling painted aluminum chassis with windows built in, for a nominal price. Many members of the community have mixed feelings about premodded systems, though, because individual creativity is the underlying pulse of modding. However, J. Barry "Cold Dog" Collins, creator of the tinted acrylic Monolith case, defends the idea of premods.

"I understand this hobby is not for everyone. If someone wants a cool-looking case and just flat doesn't have the time, why not buy one? For example, a guy who loves golf would rather be playing golf than modding a computer case," Collins says. "There's nothing wrong with him buying something nice to look at while he's at the computer."

Though Collins' views aren't shared universally, most tend to agree that premodded cases are a positive step forward in promoting modding as a hobby. But for those who do have the time and resources to devote to modding, creativity takes case design far beyond the manufactured boxes with which most of us are familiar. Many of the systems that have won awards aren't even housed in traditional cases.

Just as there is an advanced level of performance modding, there also exists a class of equipment found only on the most outrageous systems. When someone such as "Cold Dog," "Lord Pheaton," or Marc "Geezer" Weitz conceptualizes a project, that person typifies the "think outside of the box" cliché by using new plastics, metals, and lights. In fact, most of the guys who mod competitively build their entire projects from scratch. At first glance, these systems are fairly intimidating, and rightfully so, as custom cases can take months to finish. But "Cold Dog" assures, "A whole ton of mods can be done with just a jigsaw, a drill, some drill bits, a rotary tool, an assortment of files, and a soldering iron." Beyond basic

MODDERS ON MODDING

Within the modding community, there are a multitude of individuals whose talents have impressed judges at tournaments, earning themselves acclaim. And despite their celebrity status among fellow modders, these gentlemen remain down-to-earth enthusiasts with an affinity for experimental plastics, custom circuits, and unadulterated art. Dean "EnVaDor" Liou has designed such favorites as the InvisiblePC and the LovePC. Gareth "Lord Pheaton" Powell is responsible for Frostbyte, an entire system housed in clear casting resin. Marc "Geezer" Weitz received first place at CPL's C3 for his "Reign of Fire"-inspired dragon case, and Johan "Mashie" Grundstrom built the retro Anemone and SGI O2-based Oenone. J. Barry "Cold Dog" Collins fashioned a tinted acrylic case called Monolith.

CPU: Where do you derive inspiration for the mods you've created?

EnVaDor: Inspiration hits at the weirdest times. I could be walking around a grocery store and see a child's training toilet and think, "Hey, I think I can fit a MicroATX board in there."

Lord Pheaton: From looking around and observing the things around me.

Geezer: I spend a lot of time on the road, so I can be hit by something on a long road trip or in the airport. For my dragon case, I was inspired by a late night watching "Reign of Fire" on a pay-per-view channel.

Mashie: I'm always hunting for inspiration, mostly when I'm out shopping. I try to see if something never intended for computers could be used in one. Anemone is a good example. I was looking for some small, fancy case; first I was looking to use a toaster.

Cold Dog: I'm not so sure it's really inspiration in the artistic sense; more like, "How can I make this case look cooler?" Do I want to try a theme with this case or do I just want to do some basic mods? In some situations, the case is not really a PC case to begin with, so most of the effort goes into turning it into a PC case.

CPU: What advice would you give to the power user looking to get into modding?

EnVaDor: When you get into modding, do it for yourself. You are your No. 1 audience. If you're happy with it, then you've accomplished your goal.

Lord Pheaton: Don't restrict yourself. You can *always* figure out a way of doing something, and you can always mod something for cheaper than it would cost to buy. The community is highly supportive, so ask questions.

construction, fancy electronic circuitry is often a purchased luxury. Configurable LCDs and digital thermal control panels are popular. Plus, they are a boon to aesthetics and the functionality of a case.

And don't get discouraged if your first attempt at modding doesn't coincide with what you had originally planned. After all, it took "Geezer" nearly two years to finish his Alien Head mod.

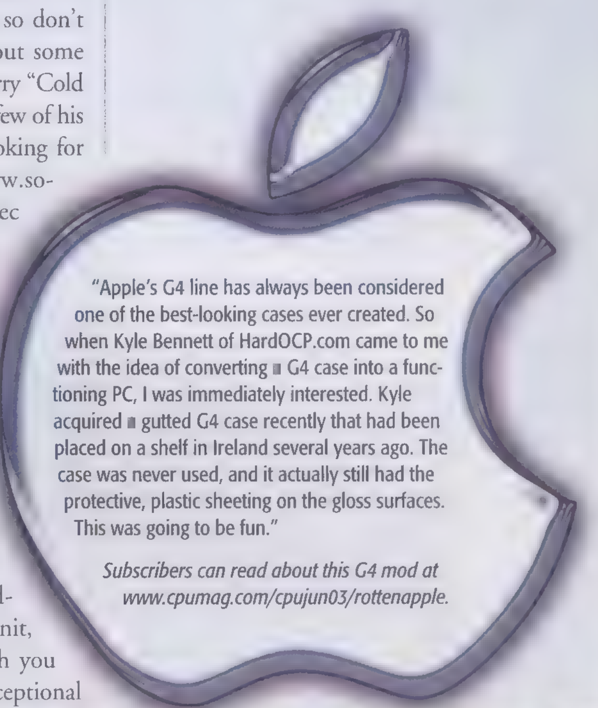
Where Do I Sign Up?

So, what began as an initiative to procure performance has evolved into a delicate blend of cutting-edge technology and seemingly impossible case design. And it's no longer an underground, do-it-yourself hobby, either. Large manufacturers have joined the fray with premodded cases that ship with Plexiglas windows built in. Cold cathode lighting kits are widely available, as are variable voltage fan controllers. Noise dampening material, custom LCD screens, and electroluminescent cabling are also available to aspiring modders interested in exploring aesthetics. If you'd like to incorporate performance, consider a Koolance watercooling kit that includes a Chenming chassis, radiator, reservoir, pump, and cooling module. The kit even sports a preinstalled window.

But before undertaking any sort of modding, do your homework. Johan "Mashie" Grundstrom, creator of the 1940s radio mod called Anemone, shares his two favorite modding forums: www.pheatonforums.com and forums.bit-tech.net. "Planning is everything," he says, so don't commit to modding a case without some idea of what you'd like to do. J. Barry "Cold Dog" Collins has shared with us a few of his favorite supply spots. If you're looking for modding supplies, try either www.sotrickcomputers.com or www.directron.com. Meanwhile, electronics experts should surf over to www.jameco.com, www.mouser.com, and www.allelectronics.com for custom components and kits.

And if you run into trouble, don't hesitate to ask for help. Octavian Busuioc, vice president of mod-centric magazine *InovaPC*, sings the praises of the folks who support PC modding: ". . . it is also a very close-knit, very helpful community in which you are bound to find nothing but exceptional people. These are some incredibly talented, brilliant individuals who are truly putting their best into creating something, and in the end, what can really be better than that?" CPU

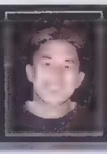
by Chris Angelini



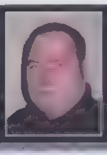
"Apple's G4 line has always been considered one of the best-looking cases ever created. So when Kyle Bennett of HardOCP.com came to me with the idea of converting a G4 case into a functioning PC, I was immediately interested. Kyle acquired a gutted G4 case recently that had been placed on a shelf in Ireland several years ago. The case was never used, and it actually still had the protective, plastic sheeting on the gloss surfaces. This was going to be fun."

Subscribers can read about this G4 mod at www.cpumag.com/cpujun03/rottenapple.

THE MODDERS:

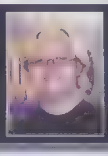


EnVaDor

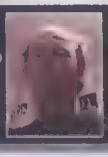


Lord Pheaton

Geezer



Mashie



Cold Dog

Geezer: Start with a blowhole; install a window. Do something relatively easy; by easing into it, the complicated mods will seem less intimidating.

Mashie: Read, read, and read some more. There are two good forums: www.pheatonforums.com and forums.bit-tech.net. Also, measure twice and cut once (even if I myself always end up measuring five times and cutting twice . . .).

Cold Dog: Bring your wallet. Just kidding. Really, a lot of case modding can be done pretty cheap. You will need a little cash for materials and supplies: lighting, electronics, fans, etc. It helps to have some construction skills and a nice assortment of tools, though it is not required. Advanced users might like to acquire a table saw, a compressor, electric or pneumatic sanders, a set of hole saws and a .5-inch cordless drill. Don't be afraid to take chances and don't be afraid to try something new. What keeps everything interesting to me is trying new things I don't have a clue about. If you get stuck at some point, there are plenty of tutorials and case mod forums on the Internet if you have a question.

CPU: How long have you spent building your projects?

EnVaDor: InvisiblePC (the original one) only took three days to actually build. I had been kicking the idea around in my head for about a week before that, though. I don't usually start a mod until I've got the whole thing visualized in my mind first.

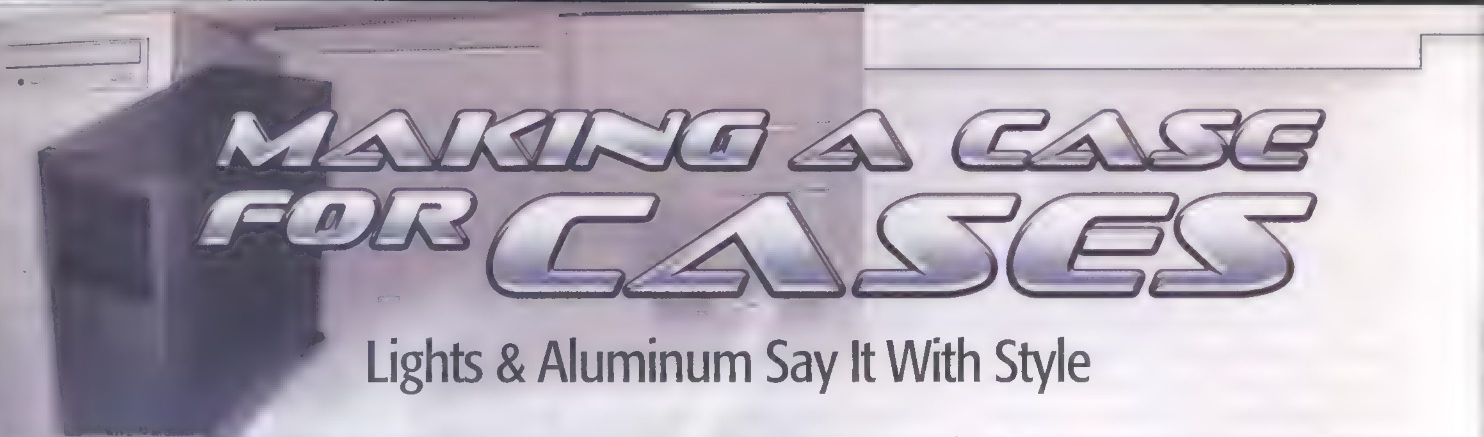
Lord Pheaton: Frostbyte took about a month to build, somewhere around 100 hours of work.

Geezer: My Alien Head mod took a year and a half! Then again, I had to start over several times when the project would go awry.

Mashie: Anemone took more than 300 hours and a few sleepless nights.

Cold Dog: I have done one in as little as a month, and I've done one over the course of five months. The first NeXT cube I converted to a PC took about four months. I'd never converted a non-PC case into a PC case, so I went kind of slow and took my time. ▲

For more, subscribers can go to www.cpumag.com/cpujun03/intromod.



MAKING A CASE FOR CASES

Lights & Aluminum Say It With Style

There are a few ways to look at what is happening with case mods. One is that clear side panels and neon really are the next logical step in PC evolution; another is that beauty is killing the beast. To sacrifice good solid engineering principles in favor of trendy looks is not what we are about here at *CPU*. Thus, we are big fans of aluminum cases. Sure, they look great and are easier to lug around to LAN parties, but they also dissipate heat more effectively than plastic or steel-sided cases. Remember this when you opt to punch a big hole in your aluminum side and replace it with a window.

Actually, the days of cutting holes in slabs of sheet metal in the privacy of your own garage may be numbered. Because case windows have become so popular and affordable, they are available off the shelf for just about any case configuration and price point. So, for each of our premodded case selections, minimum features include at least one window and front port USB support. We have also opted to stick primarily with aluminum construction.

Function & Form

To show the range of products available, we have aimed for a sampling of case mods and models that will appeal to a variety of users. (See the "Casing The Options" chart for detailed specs of each case.) Although these user descriptions are obvious stereotypes, we all must fit in somewhere. . . .

Antec LANBOY. Trendy gamers wanting portability and economy with style could do worse than our smallest, lightest, and least expensive case, the Antec LANBOY (www.antec-inc.com). Besides the $99 price tag, highlights are the included SmartBlue 350 power supply with internal blue illumination ($65 if purchased separately), its relatively small size, and a handy carrying strap. Even though it has the fewest drive bays (a total of eight), this case still packs a lot into a small box. The removable 3.5-inch drive rack is handy but not the best bet for heat-generating multiple hard drives or RAID arrays. Add $20 for two blue LED 80mm fans, and the overall impression is a nice blue glow pulsing through the window of a highly portable, lightweight, aluminum case. The matching finish plastic front bay door cover creates a smooth, clean line to hide ugly or unmatched drive faceplates but can seem a bit tacky up close. Traditional screw construction is not very handy for quick component changes.

CHOOSING TO MOD

Modding involves a significant investment in time and resources and can permanently alter your relationship with your hardware. Modding is not for everyone, but if you feel compelled, here are a few things to think about.

Keep it functional. Go for core functionality when selecting a case to mod. Looks go a long way, until you need another internal drive bay or discover your oversized graphics card won't fit. You need to address questions about form factor, drive bay count, power supply and cooling needs, front port features, and overall cost before you cut your custom window and void the warranty. High-speed and overclocked CPUs/GPUs and multiple HDD need special cooling attention. Neon may look cool, but it doesn't actually lower operating temperatures.

Discover your own personal style. The whole point of customization is to create something that is unique and expressive. Whether you modify off-the-shelf designs or create your own, bring all of your aesthetic preferences into the process. Don't overlook crystal chandeliers or bubblegum tattoos if they reflect who you are. Creative experimentation can be a scary business, but humor in the face of fear is always impressive.

Be realistic. Unless you are going for that humor angle, a truly fabulous paint job on a really ugly case is not likely to achieve the effect you are seeking. Your choice of materials will have a large impact on the overall success of the project, and there are good reasons most cases are made from metal and plastic instead of clay and wood. ▲

Lian Li PC-65. Compulsive hardware upgraders going for classic fit and finish have made the Lian Li PC-65 (www.lian-li.com) so popular it has become a standard. A slide-out motherboard tray, detachable motherboard harness, quick-release power supply bracket, removable hard drive cage, tool-less detachable front panel, and thumbscrews everywhere make installing and upgrading easy and painless. The anodized aluminum finish, bright blue and red power and hard drive LEDs, and rivets around the window bring a distinctive, serious look to this distinctive, serious case. The highly efficient cooling scheme relies on two speed-controlled, filtered intake fans up front and a single exhaust in the rear. Power supply not included.

ThermalTake Xaser III Super Tower series. Sporty gadget freaks with control issues might consider one of ThermalTake's Xaser III series cases (www.thermaltake.com) to find feature-rich (USB, 1394, mic, and speaker) front

THE RIGHT TOOLS FOR THE JOB

When installing hardware into premodded cases, you can usually get by with a screwdriver and opposable thumbs, but if you have big hands that don't fit into tiny spaces, make it easy on yourself with some needle-nose pliers and a set of long-handled screwdrivers. A selection of different sizes and colors of plastic tie wraps are indispensable for all kinds of internal rigging, and a pair of small diagonal cutters are best for close-trimming the long ends, as well as striping/cutting wires.

For serious modding, you'll need some power tools. A power drill for pilot holes and a jigsaw for cutouts are the best way to go. A Dremel tool with a sander/grinder is nice for smoothing cut edges, but not great for cutting windows. Sandpaper also does the trick. We don't recommend manual sheet metal cutters for window cutouts either, but they can be OK for very small jobs.

Beginners should practice on an old case or buy a cheap one before cutting into anything expensive. Remember that freshly cut metal is very sharp and needs sanding before it becomes finger-friendly. And if you plan on using power tools or cutting metal, get a pair of safety glasses and put them on your face!

For painting, preparation is the key. Be sure to take time to disassemble, sand, clean, and prime the case parts to be painted. Follow paint manufacturer instructions and use a dust mask and drop cloth for protection. Other handy items: measuring tape, straight edge, compass, French curves, pencil, eraser, masking tape, Exacto knife, and scissors. ▲

Antec LANBOY

ports, monstrous (but quiet) cooling capacity and control, complete flexibility on ATX motherboard size accommodation, and a mechanical lock to keep out snoopers. If your taste in sports shoes runs toward high-performance with multicolor decorative cutouts, the Xaser III should satisfy. Each color combination comes with or without a window so you can choose to thwart peepers as well as snoopers. At 18.7 pounds for the silver all-aluminum and a whopping 37.5 pounds for the black and blue steel /aluminum units, it's a bit of a porker.

Kingwin KT-436 series. For the complete exhibitionist, each case in Kingwin's KT-436 series (www.kingwin.com) has three windows. Whether you are a tidy tie-wrapper or a negligent screw replacer, your inner workings will be on display along with your hardware. Heavy-duty front panel support (four USB, FireWire, mic, and headphone) and more drive bays than the rest of the pack make the comprehensive cooling solution a welcome necessity.

Cooler Master ATC-220 series. With much the same appeal as the Lian Li with

Cooler Master
ATC-220 Series

a bit more refinement and some beautiful light work, Cooler Master's ATC-220 series (www.coolermaster.com) is a standout. Older versions of the Cooler Master colored acrylic front door were texture-etched to hide your drive covers, but newer units are tinted clear with the ATC or Cooler Master logos (we've seen both) etched to catch the LED light, so you may opt to invest in fashion drive covers. Front USB ports are accessible through a cutout even with the door closed, but front bay-mounted components with knobs or jacks may necessitate open door operation. A drawer-style motherboard tray, tool-less thumbscrews, and finger-friendly edges make for easy assembly. One blowhole and one rear fan provide adequate cooling, but you may need to supplement them for heat-intensive setups.

Enermax CS-5190AL series. Big, heavy, solid, and pricey with shiny auto body paint and wheels, the Enermax CS-5190AL series (www.enermax.com.tw) is definitely the Hummer2 of cases. That would make the prototype user someone who really appreciates heavy gear. The slanted front creates interesting visual impact and access, but angled drive mounts seem like a less-than-terrific idea. With up to seven fans; fan speed controls; a temperature sensor; optional voltage regulators; and front-panel support for USB, FireWire, audio in/out/mic, and volume control, the icing on this mammoth has to be that front joystick port. That right there is what separates the adventurer from the soccer mom.

ClearPC. If Kingwin's three-windowed case doesn't have enough visibility for you, ClearPC's (www.clearpc.ca) 90% cast clear Lucite cases provide the Full Monty experience. The completely rounded-over, unibody design ships with clear acrylic standoffs for 3.5-inch components and the motherboard to create the illusion that they are floating within

CASING THE OPTIONS

If you're in the market for a premodded case, it doesn't hurt to compare the specs on some of the top choices.

Manufacturer	Model/Series	Case Type	Lowest Web Price	Dimensions (HxWxD; Inches)	Weight	Color Options	Front Ports	Slots
Antec	LANBOY	ATX Minitower	$99 ($119 with fans)	16.5 x 8.25 x 16.5	10.8 pounds	Silver	Two USB	7
Lian Li	PC-65	ATX Midtower	$169	17.71 x 8.26 x 19.28	17.34 pounds with fans	Silver; Black	Two USB 2.0	7
ThermalTake	Xaser III Super Tower Series	ATX Tower	$165 to $200 with window	20.9 x 8.1 x 20.5	18.7 pounds (*37.5 pounds)	Silver with Red; *Black with Red; *Blue with White	Two USB 2.0, FireWire, Mic, Headphone	7
Kingwin	KT-436 Series	ATX Midtower	$146 to $159	18.11 x 8.27 x 19.68	13 pounds	Silver; Silver with Blue; Silver with Black	Four USB, FireWire, Mic, Headphone	7
Cooler Master	ATC-220 Series	ATX Tower	Approx. $215	17.87 x 7.71 x 21.65	15.4 pounds	Silver with Blue, Pink, or Green; Black with Blue	Two USB	7
Enermax	CS-5190AL Series	ATX Midtower	$385	16.53 x 7.87 x 24.01	20 pounds	Silver (Clear-coat); Blue, Red, or Black Auto Coat	USB, FireWire, Audio In/Out /Mic, Volume, Game Port	7
ClearPC	ATX	ATX Midtower	$99	16.81 x 8.68 x 18.37	13 pounds	3/16-inch Cast Clear Lucite	Power Switch, LEDs	7

the case. Necessary hardware to install one floppy drive, one hard drive, and one CD-ROM drive is included, but you will have to order additional screws and standoffs if you have more components. A full line of clear parts and accessories is also available. You must take some extra care during the installation process to avoid scratching and over-tightening screws, but once the unit is assembled with your components, the ClearPC pretty much functions just like any other case. A detailed set of assembly instructions with photos, suggestions for modifications, and a list of colored components is available online and worth checking out before you take the plunge.

Compulsive hardware upgraders going for classic fit and finish have made the Lian Li PC-65 so popular it has become a standard.

Lian Li PC-65

Other Form Factors

Sometimes modding is just repackaging a PC to look like something else. With the popularity of the "media center PC" concept, traditional tower shapes are no longer required, and various small form factor PC cases have arrived. Cooler Master's ATC-630 series micro ATX comes in silver or black, sits less than 4.5-inches tall and looks like a stereo component. But up-front dual USB, FireWire, and audio ports; dual 5.25-inch bays and two internal 3.5-inch bays; four low-profile expansion slots; a 3.2-inch fan; and an included 200W power supply say differently. Another recent success story is Shuttle Computer Group's (www.shuttlegroup.com) XPC line of small form factor barebones systems, each no bigger than a four-slice bagel toaster but packed with full-sized features and a long list of mod accessories.

Consider All The Issues

When evaluating a case, look at balancing the aesthetic issues with practical

Drive Bays						CPU	
Front 5.25"	Front 3.5"	Internal 3.5"	Fans	Mainboard Tray	Power Supply	Rating	Goodies
4	2	2	Optional Two 3.2-inch: One Front, One Rear	Standard ATX	350W, ATX12V with Blue LED	3.5	ABS plastic front door; windowed side panel; quick release drive cage; internal blue illumination on PS; case carrying strap with handle
4	3	5	Three 3.2-inch: Two Front w/Filter, One Rear	Sliding ATX, P4 Ready	No	4	Fan speed controller; tool-less detachable front panel; windowed side panel; high-performance "jet flow" ventilation system
4	2	6	Seven 3.2-inch 30dBA: w/Filter: Two Front Plus Two Side, Two Rear, One Top	Standard, Micro & Extended ATX	Optional 360W to 420W	4	Record/adjust preset temp alarm, °C/°F display, four-channel adjustable fan speed, E-LED blue light and two-way lock-in aluminum front panel. Optional window. * Black & Blue units are steel with aluminum bezel.
4	3	6	Five 3.2-inch: Two Front, Two Rear, One Top	Slide Out ATX	No	4	Acrylic front panel and three windows; tool-less assembly
4	2	4	Two 3.2-inch: One Top, One Rear	Drawer Style Standard ATX	Optional 300 to 400W	4.5	Tool-less assembly; colored acrylic front door and side window; speaker; nifty logo LED on front door
4	3	3	Up to Seven. 3.2-inch: One Front plus Two Side, 2.4-inch:Two Back, plus Two Optional	Slide-In/Removable ATX, P4	Optional 350 to 550W	3	Entry-level server case. Shiny auto coating, fan speed control, side window, slanted front, wheels, temperature sensor, optional Voltage Requlators.
4	1	3	Optional Two 3.2-inch or 4.8-inch: One Front, One Rear	ATX, Micro-ATX	No	4.5	Many clear accessories. Also available in Micro ATX ($69) and Grande ($129) sizes.

ThermalTake Xaser III Super Tower Series

logistics and pay special attention to the following areas:

Doors. Front door panels can cause problems if you have a front-mounted 5.25-inch remote breakout for your sound card. Knobs, cables, and headphone jacks can interfere with closing the door, so you may need extra working clearance around the front of your machine for the door to stay open. Small mini-jack elbow adapters may solve the problem if the door is offset far enough from the front of the case; otherwise, try recessing the mount to accommodate knobs and cables.

Windows. Now that the whole world can see into your machine, you have to decide what to put on display, and upgrading each visible component based solely on looks can be expensive and time-consuming and can leave you with inferior components. Remember that Mattel didn't really make its money on Barbie dolls; it was all those darn color-coordinated outfits with matching accessories! Choose wisely and have a plan.

Lighting. Reflected or bounced light can be more subtle and aesthetically pleasing than a harsh bare tube. Bright or pulse lighting that you cannot easily disable independently from PC power can become really annoying if, for example, your PC is also your source of, ahem, mood music. Colored lights will distort the appearance of color-coded wiring and components inside the case, so verify under white light before cutting or altering.

Motherboard trays. Sliding/removable trays surely are the CaseMaster's gift to DIYers, but not all trays are created equal. Unless there is actually enough slide-through clearance inside the case for all your components, prebuilding the entire motherboard assembly outside the case can be an exercise in frustration. To avoid this, do an eyeball check as you mount each component. If it looks even close, wait until you've inserted the tray to mount larger items.

Drive bay cages. Just because you can stack them in there doesn't mean you should. If you are running an array or multiple hard drives, consider a 3.5-inch mountable cooling unit, especially if your fan inventory is minimal, and keep that extra space requirement in mind when making your case selection.

Stress-Free Modding

There is no such beast. If you decide to take the plunge anyway, plan ahead, try to purchase all the components you will need before you start building, and give yourself plenty of time to get things back together and functional before homework or deadlines loom large. With all the products, support, forums, and ideas available, nobody has to settle for beige. CPU

by Joan Wood

Enermax CS-5190AL Series

Kingwin KT-436 Series

ClearPC

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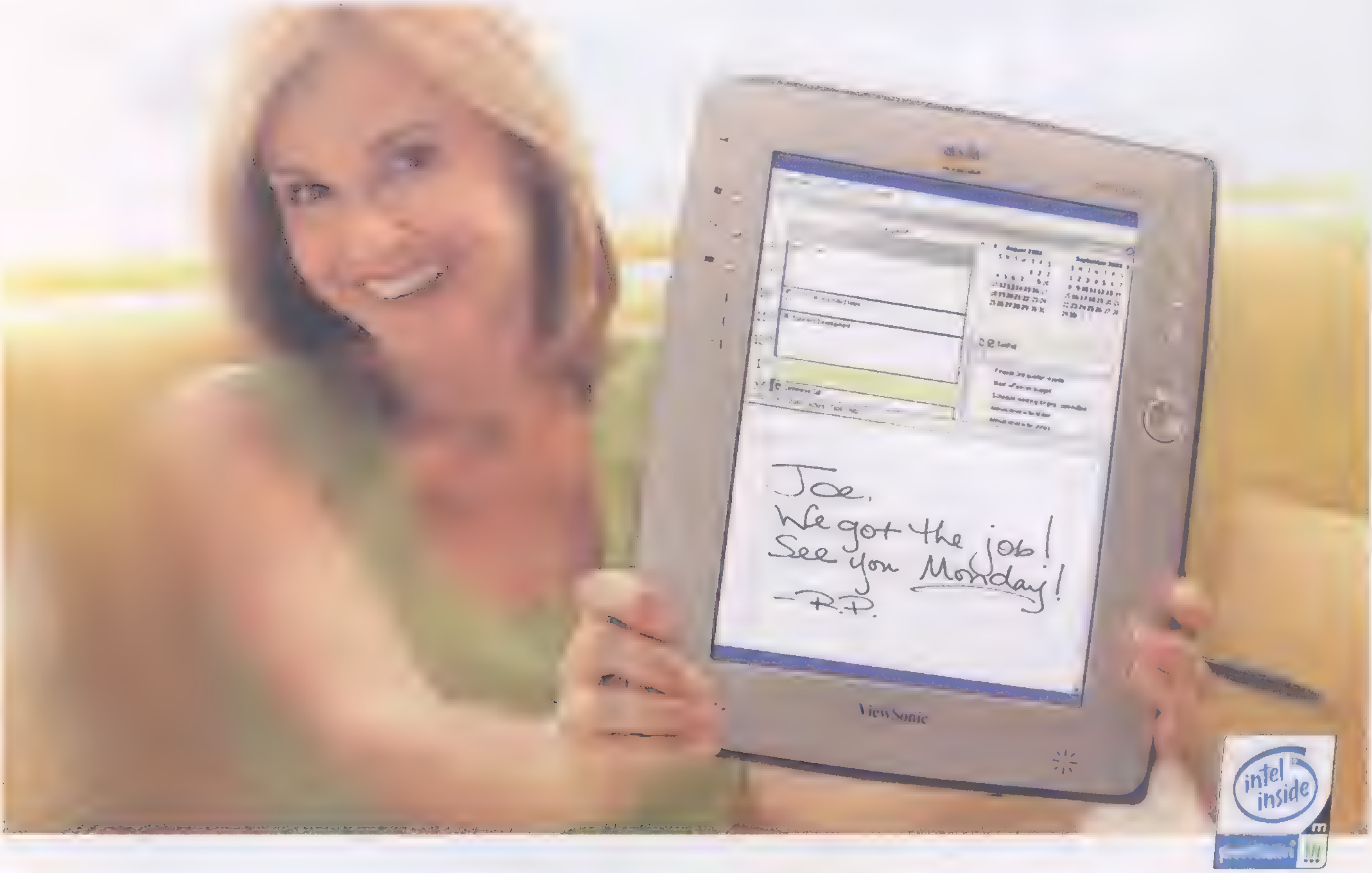

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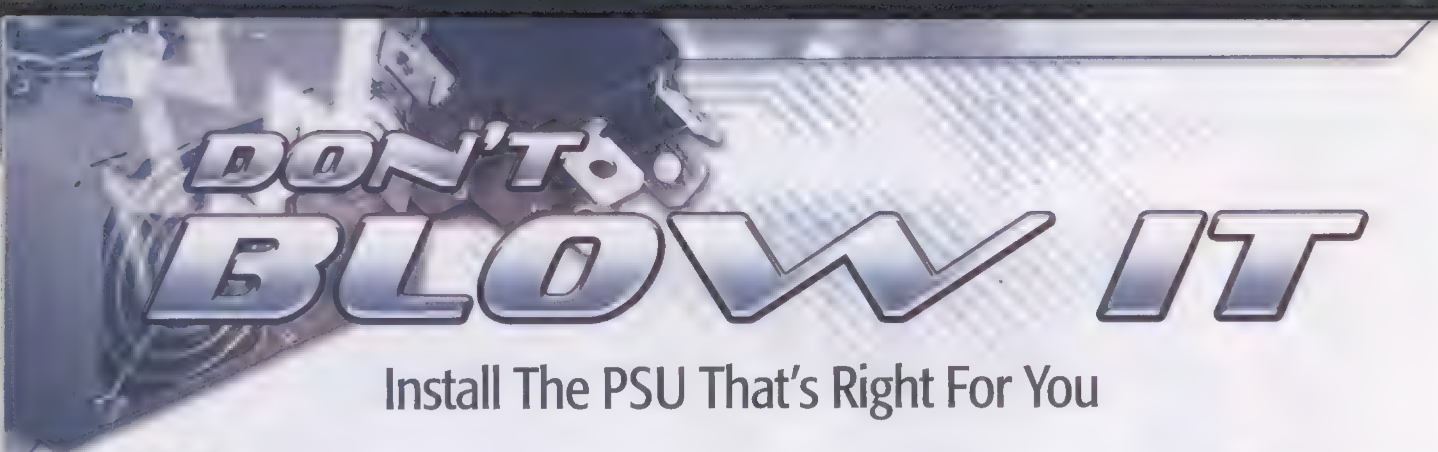

DON'T BLOW IT

Install The PSU That's Right For You

You love to upgrade. Who doesn't? About all that old Pentium box was good for anymore was Solitaire and maybe as a print server. So you gave it the cost-effective overhaul: a new mobo, CPU, RAM, graphics card, burner, and hard drive. Same pretty face, but now all new brains.

There is only one problem. The first time you try multitasking on the new configuration, you hear a loud pop and the screen goes black. Then you smell the stench of ozone and Kentucky Fried PCB. Your old power supply wasn't made for this kind of load, so out blew one of its critical components. In fact, even if you are using a brand new computer, odds are you still got stuck with the lowest common denominator in power supplies. Why? Because hardly anyone understands how much power a system should have, including the people who sold you the box. To make sure a power crisis isn't in your PC's future, let's see how to really determine your power requirements.

Going Off The Rails

Pick any four-wire power connector coming off of a power supply and you'll see three rails, or lines: black (+3.3V), red (+5V), and yellow (+12V). These three circuits run throughout the system, and each powered PC component places a certain load on one, two, or all three. An AGP card, for example, uses the 3.3V and 5V rails, while a modern CPU uses the 12V. (CPUs used to use the 5V line, which is why some older power supplies built for that generation sometimes run into trouble. To accommodate this shift, modern ATX12V power supplies have a separate four-wire +12V power connector. Older ATX PSes lack this, so make sure your unit is ATX12V.) You may have a 250W power supply that's only drawing 200W, but if your power supply supports a maximum of 25A on the 5V line and you're drawing 30A, you are about to have a serious problem. This is why it's important to take the total wattage as only one important factor and not the whole power picture.

No power supply we have seen delivers perfectly accurate voltage output, which is fine because Intel's recommended tolerance is ±5%. Thus, the 3.3V rail can safely vary from 3.14V to 3.47V, the 5V rail from 4.75V to 5.25V, and the 12V rail from 11.40V to 12.60V. All the PSUs we tested were comfortably within this zone, with the average tending toward 1% to 2% over voltage.

To illustrate, let's look at a standard PC configuration. We used many of the figures listed at AMD's site in the "Builder's Guide for Desktop/Tower Systems" document and also Intel's "Performance ATX Desktop System Thermal Design Suggestions" document. The biggest voltage hog in your PC is the CPU; you can determine its power consumption on the 12V rail using the following formula: 1.25/12*core voltage*current. For a quick and dirty rule, figure that 1GHz processors require roughly 6A and 3GHz require about 10A.

For the other components, we used AMD's and Intel's numbers to build the chart that's shown on this page for maximum current and power draw. Sometimes these may not be wholly accurate. For example, AMD notes a 2A maximum draw for an IDE drive on the 12V rail, but the actual spec for a Western Digital WD1200 120GB drive is only 0.45A. (The 5V spec of 0.80A, however, is a match.)

CURRENT & DRAW

We used AMD and Intel numbers to build this chart of our components' maximum current and power draw.

Component	Qty	+3.3V	+5V	+12V	Power
Motherboard	1	3	2	0.3	23.5
Case fan	2			0.5	6
CPU fan	1			0.25	3
128MB DIMM	2		4		20
AGP card	1	3			9.9
IDE hard drive	2		1.6	4	56
CD-RW drive	2		2.4	1.6	31.2
Floppy drive	1		0.8		4
USB devices	2		1		10
FireWire devices	2		3.2		16
Keyboard	1		0.25		1.25
Mouse	1		0.25		1.25
Subtotal		6	15.5	6.65	182.1
Add 3GHz processor (approx.)				10	95
Total		**6**	**15.5**	**16.65**	**277.1**

It's likely you won't have all these components operating at full capacity simultaneously. Conversely, between unit-to-unit variance and what we'll call "occasional over-optimism in marketing," some power supplies may not be able to achieve their full-rated capacity. To be safe and leave room for future upgrading, consider padding these numbers by 20% to 30%. Thus, although our Chieftec unit, for example, has plenty of headroom for power, the 12V rail is only 8% over our present maximum, which is getting a little close for comfort.

Note that AMD's maximum continuous load spec for a recommended 300W power supply is 28A on the 3.3V rail and 30A on the 5V rail, but only 15A on the 12V rail. So be safe, and always read the fine print.

Real-Life Hands-On

Performance tests that push hardware to the extreme can make for great reading. Capacitors explode, parts catch on fire, and the marketer's claims are exposed for the bunk they often are. When it comes to power supplies, though, we decided to pursue real-world tests. After all, everyday users—even the wide selection of power users among our readers—simply aren't going to max out a decent 450W power supply, save for the handful of multitask-happy, gadget-gobbling enthusiasts determined to prove us wrong.

We received six power supplies from leading vendors, but we puzzled over how to test them in a way that would be meaningful to regular use. We finally settled on two factors: noise and power fluctuation. We set up our test bench expecting a fair amount of diversity in our results. However, the outcome was as encouraging as it was undramatic.

To test audio, we set a Radio Shack digital sound level meter 12 inches from the power supply at a roughly 45-degree angle from the rear fan so as to avoid any blown air from hitting the microphone. We tested late at night to eliminate such background noise as passing cars, planes, and stray talking. We were still left with a bit of white noise from the building's air system.

Our meter featured two modes: one tested in the 500-to-10,000Hz range and a second in the 32-to-10,000Hz range. In the first mode, our power supplies all registered below the floor of our meter's 50dB threshold. In the second mode, our environment averaged a 52dB noise level with no power supplies present. The test then was to see how much noise the power supply would add above this baseline.

(NOTE: We ran our audio test with only the power supply plugged into our test motherboard and all other fans unplugged. [Yes, the board does shut down after about five minutes because the CPU is overheating.] Obviously, there's no such thing as a "silent" power supply, even if the unit is quiet enough not to budge our audio meter. However, even the loudest of our units [the Vantec running in High mode] is buried under the cacophony of the system's other fans once they're all plugged in and operating normally. In other words, the sound from even the noisiest of so-called quiet power supplies is negligible versus your other fan components.)

For power fluctuation, we used a digital multimeter and took measurements on the 5V and 12V rails from each power supply while idling at the Windows Desktop and while running three drives simultaneously. Our test system used a 2.8GHz Pentium 4 with two 256MB sticks of DDR333 alongside an ATI RADEON 9800 PRO. Given that the CPU, north bridge, and GPU all had their own fans, we figured this gave a pretty fair configuration for a conventional high-end system under moderately heavy use.

Here's what we found:

Antec True480 Watt

Antec True480 Watt

$99
Antec
www.antec-inc.com
Rated output: 460W maximum; 3.3V–30A, 5V–38A, 12V–22A

This unit features two double ball-bearing fans, a standard rear blower, and a slightly larger bottom-mounted intake fan to pull in hot air from the chassis. Both fans sport gold grilles and translucent fan blades to show off their blue LEDs. (Would we pay extra for this silly bling bling? Yeah, because it looks sweet.) On top of the usual plethora of power connectors, the True480 includes two fan-only Molex connectors, a fan speed-monitoring connector, and even an external 4-pin connector. An internal controller helps adjust the speed of power supply and case fans for minimum noise output.

The Antec registered only 53dB, a bare purr above our baseline. We noticed a slight rhythmic brushing noise during initial power-up that quickly faded. Of all our units, the True480 was the most stable. It held steady at 5.06V and 12.01V throughout not only idle and running states, but even in system boot and shutdown, which is normally when power will vacillate the most. For flash and functionality, we were very impressed with Antec.

Chieftec HPC-420-102 DF

$59
Chieftec
www.chieftecusa.com
Rated output: 400W maximum; 3.3V–30A, 5V–40A, 12V–18A

Apart from the gold grilles over the rear blower and bottom intake fans, Chieftec's entry here looks like a standard, gray, boring power supply. However, it's solidly built with over-thermal and over-voltage protection and a fan system that pokes along at 1,300rpm at room temperature while scaling up to 2,400rpm at 80 degrees Celsius.

The unit has a fan-monitoring connector in addition to the usual power plugs, but no other "extra" features of note. To its credit, this Chieftec PS was very quiet, averaging a feathery 53dB on our meter. However, whereas Antec showed the most stable voltage, Chieftec's was the least stable. During bootup, our 5V rail varied from 5.14 to 5.18V and the 12V fluxed between 12.02 and 12.17V. During idle and loaded states, we still saw a little wiggle, most notably on the 12V line, which wandered from 12.12 to 12.14V.

Realistically, though, this is like criticizing a $1 million house because its courtyard is a bit small. Chieftec's variance is still well within the bounds of safe operation and shouldn't be viewed too harshly. Our only caution is to keep an eye on this unit's slightly underpowered 12V rail. A next-generation CPU running alongside a stack of hard and optical drives in a case with multiple system fans might be enough to swamp this line.

Fortron Source FSP530-60GNA

$89
Forton Source
www.fortron-source.com
Rated output: 510W maximum; 3.3V–28A, 5V–40A, 12V–18A

Fortron Source FSP530-60GNA

Fortron Source is often held up as the standard in design and quality in the power supply industry, and the brand is famous for being one of the most underrated (in terms of load capacity) designs on the market. In other words, if we'd pushed our unit to its limit, we might have seen the FSP530 tackle 580W or even more. It's interesting, though, that the twin-fan unit places its intake in the rear of the power supply, going against AMD's design recommendation, and there are no other vent openings in the casing, unlike the other models we evaluated.

With a sleek, brushed-chrome exterior and gold fan grilles, this unit looks as good as it performs. Our sound level bumped to only 54dB, and the most voltage variance we saw was on the 12V line during bootup, which ranged from 11.99 to 12.04V. During regular operation, the unit held steady at 5.10V and 12.05V. Again, we wish Fortron had beefed up the 12V line's total amperage, but the 5V rail sports a plentiful 40A, which will be welcome news to those running a host of add-on cards and external high-speed peripherals. You won't find any frills here, but rest assured that the premium in Fortron's price is going toward component quality and safety.

Vantec VAN-470A

Seasonic SS-300FS

$45
Seasonic
www.seasonic.com
Rated output: 180W maximum; 3.3V–28A, 5V–30A, 12V–15A

"Yikes," you're thinking. 180W? Are we crazy? But listen . . . hear that? Right, that sound you don't hear is this power supply. Seasonic rates this unit at 25.8dB under a 70W load from a distance of 30cm. The SS-300FS didn't even make a dent in our in-house audio test. Sure, the model looks boring, but you get a dual ball-bearing fan despite the lack of outward signs indicating so. Moreover, you still get over-voltage and over-power protection, short-circuit protection on all connectors, and a standard fan control lead.

You wouldn't want to use this power supply in your main PC. The 12V line alone falls too close to our recommended margin of error for a well-stocked, high-speed tower. However, think about secondary PCs in high-traffic areas where quiet is valued over power—bedroom, living room, and small office. Our tests showed the Seasonic's voltage to be quite steady, and we wouldn't hesitate to use this model to fuel small ATX machines as a lower-cost alternative to small form-factor boxes.

Vantec VAN-470A

$139.99
Vantec
www.vantecusa.com
Rated output: 450W maximum; 3.3V–26A, 5V–47A, 12V–28A

We saved the best for last. The bad news is that with three dual ball-bearing fans, the VAN-470A isn't the quietest unit in our roundup. But the fan has three manual settings you can switch among: Auto, Low, and Medium. On Auto, which enables the temperature sensor inside the power supply, our audio meter averaged 54dB. On Low, we dropped down to our baseline at 52dB, while the Medium setting yielded 56 to 57dB. Our test unit put out a soft but constant fan buzz that immediately ceased to be audible when we kicked the CPU fan on. Going from Windows idle to a moderate activity load, the VAN-470A stayed nice and steady at 5.09V and 12.16V.

Vantec opted for a black anodized aluminum casing that's downright sexy and a bit lighter than the standard sheet-metal design. (No bling-bling LEDs, though.) Other unique features include two Serial ATA power adapters, a whopping nine four-wire Molex connectors, and a rare 24-pin ATX power connector, which will require using the bundled 24-to-20-pin adapter with most boards. You also get an external AC output plug—strange but potentially useful.

Vantec glimpsed the future and prepped this power supply for anything you want to throw at it. The critical 5V and 12V rails both have plenty of headroom. If you have a monster machine that needs fed plenty of power, look no further than the VAN-470A.

by William Van Winkle

(For our reviews of the StarTech.com Silent 350W SS-350FS and Thermaltake W0009 ATX420W, subscribers can go to www.cpumag.com/cpujun03/powersupplies.)

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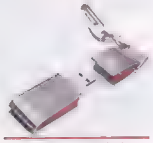

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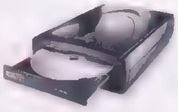

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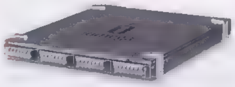

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BE COOL & QUIET DOWN

Advice For Keeping Your Rig Silently Chilled

As a power user, you can't win. You want your PC running fast and furious, which means several components generating substantial heat you need to remove in a hurry. But you also want your machine to run quietly. After all, roaring engines and rustling footsteps just aren't the same when you're struggling to hear them over the din of half a dozen system fans.

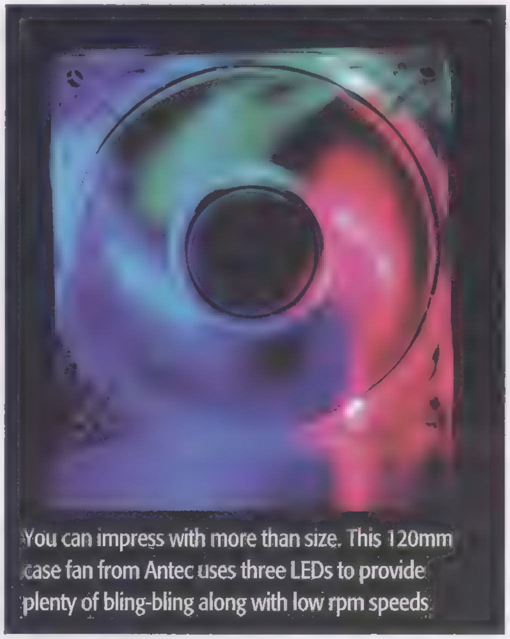
There is a silver lining, though. You may never achieve absolute silence with an overclocked monster, but you can obtain surprisingly quiet results while still retaining plenty of horsepower. The key isn't turning your PC into a wind tunnel, but rather understanding some thermal basics and choosing cooling tools that deliver optimal efficiency.

CPU Heatsinks

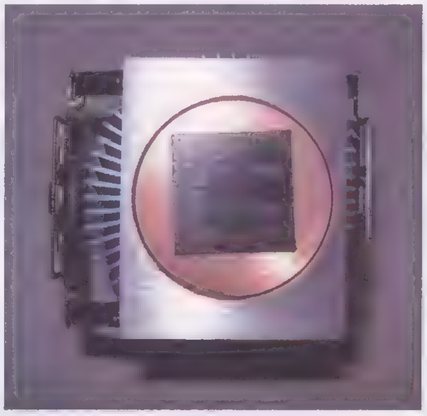
The principle of heatsinks is like that of an automotive radiator. You have a heat-generating body—the CPU core—that must run within a prudent temperature range or you risk overheating and malfunctioning. Push the temperature too high and you can damage the chip permanently. (Fortunately, many modern chips have built-in sensors to prevent the chip from attempting to run when overheated.) The heatsink's metal contacts the CPU's surface and moves heat away from the core out into an array of thin fins. Air moving between the fins removes heat from the metal and out into the chassis' surrounding environment.

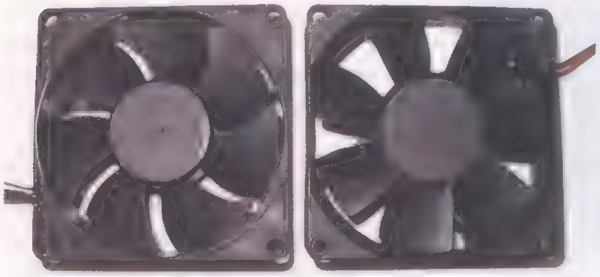
A bare heatsink strapped to a CPU is called a "passive heatsink." An "active heatsink" is the same thing but with a fan attached to the top to pull more air through the fins and remove heat more quickly. Back in the 486 days, passive CPU cooling was sufficient, but as Pentiums started rolling around, active heatsinks were practically mandatory.

Nearly all heatsinks use a clip mechanism that loops over a lip on each side of the CPU socket. One side of this clip has a tab that sticks out. You attach the other side of the clip first (because it's easier), and then grab this tab to push it down and over the socket lip. Without a specialized instrument to do this, the most common options are using needle-nose pliers (our preference) or a screwdriver. Note that we've damaged and destroyed an embarrassing number of motherboards over the years by slipping during the rather difficult process of attaching this second clip side, sending our screwdriver off the clip and down into the PCB. According to Intel, this is the leading way users damage their boards. Smart mobo designs put the second clip at the board's edge so if you do slip, you're only gouging the underlying table. However, if you're stuck with a design that has the second clip facing into the board, put a thin piece of hard plastic—such as a clean yogurt cup—under the socket lip during installation for protection.


You can impress with more than size. This 120mm case fan from Antec uses three LEDs to provide plenty of bling-bling along with low rpm speeds.

Before connecting the heatsink to the CPU socket, inspect the die surface and heatsink bottom to make sure they're smooth. If not, use a dust-free cloth moistened with rubbing alcohol to make sure each surface is clean and free of any matter that could impede heat transfer. In addition, remember to use thermal grease. Apply this white, viscous substance to a chip's surface to ensure there are no gaps between the die surface and heatsink. You want the grease to cover the entire die, but you don't want the coating too thin or too thick. Apply a dot of grease in the middle of your die, rub it around, gently apply even pressure with the heatsink, then wipe away the excess. Lift away the heatsink. With a proper coating, you should see a lattice of raised, spidery grease ridges over the die and heatsink where the two make proper contact, yet you should still make out the CPU's underlying color. Fill in any gaps, double-check for an even coating, and install the heatsink for real.


This posterior view of a Thermaltake Orb heatsink shows the copper core hidden within the extruded aluminum exterior and some old thermal tape in need of removal before we can add new thermal grease.



A Mechatronics case fan on the left and a Sunon fan on the right, both with identical size, CFM, and rpm specs. Note the difference in blade design, though. The shark fin style of Mechatronics provides superior air movement and backpressure vs. the underperforming, squarish-blade design of Sunon, which shows more space between the blades.

PHOTO COURTESY OF PCToys.com.

Some chips may have thermal tape already applied to the die. Thermal tape is OK, but consider replacing this with thermal grease, which is conductively superior. Be warned that Intel recommends that you *not* remove the thermal tape it affixes to its boxed processor heatsinks and will consider the product warranty voided if you do. AMD only suggests you use AMD-recommended thermal compounds.

Heatsink Construction

You can make heatsinks out of many substances, but aluminum and copper are most common. Copper has roughly 80% better thermal conductive ability than aluminum. (Silver has 93% better thermal conductive ability, but its price makes such heatsinks prohibitively rare.) This makes copper the natural choice for overclockers, but copper's downsides are its considerably higher weight and the need for better active cooling. After all, if the copper is drawing away heat from the CPU more quickly, you still need a way to get rid of the heat.

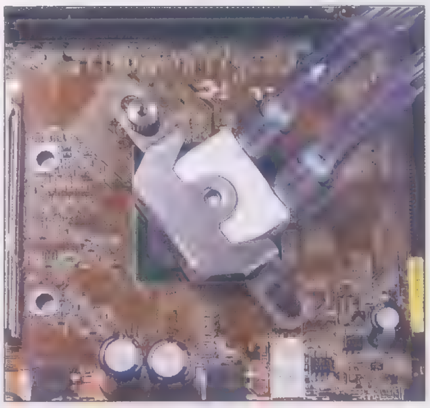
Some copper coolers, most notably Zalman's "flower" design in the CNPS6000-Cu, do such an effective job of moving heat off the CPU, they don't need attached fans under regular CPU operation, although an optional, variable speed 92mm fan is available.

Perhaps the most extreme (and extremely cool) heatsink design today is Zalman's CNPS7000-Cu. The copper heatsink is built like a flat-bottomed bowl. The fins (which radiate out from the center) form the bowl's sides. In the bowl's cavity is a 92mm fan that works from 2,400rpm down to a hardly audible 1,350rpm. The fin orientation, ingenious dissipation design, and copper material ensure the fan doesn't have to work terribly hard to efficiently remove heat. (Note that the heatsink is also cross-compatible with today's Intel Socket 478 and tomorrow's AMD Socket 754 Hammer design.) Physically, however, it's a beast, weighing 1.7 pounds and measuring 4.3 inches in diameter.

Because such bulk could snap socket clip connections (and perhaps the entire socket) clean off during a moderate case jarring, Zalman includes a clever screw-based retention mechanism for more secure mounting. There's still the problem, though, of hoping the CD-sized heatsink doesn't butt into your DIMMs, cards, drive cage, or other components.

To strike a fair compromise in materials, many mainstream heatsinks feature a copper disk or column that sits atop the CPU die joined to extruded aluminum fins. A good example is Cooler Master's lineup, Spire's QuieTude II, or AVC's 112C86, the first heatsink approved by AMD for 3200+ chips. Although a 100% copper cooler may be more than you need, we'd recommend at least a copper/aluminum hybrid part for overclockers.

There may be more to heat dissipation than just the heatsink metal, though. You can have a 4,500rpm fan sitting on a quality copper heatsink with solid, parallel fins and move up to a 6,800rpm fan and only measure 2 to 3 degrees Celsius difference in the CPU. Part of the reason for these diminishing returns is that excess turbulence can build up among solid, parallel fins. You're blowing this large quantity of air down from an area that spans almost the entire heatsink, but there are only two directions the air can exit: left and right. If the heatsink uses an array of narrow blades, or rods, rather than broad fins, the air can escape in four directions and produce a more efficient effect. This turbulence effect is partially why vendors such as Thermaltake and Zalman opt for radial designs in which the fins appear to point or twist (as in the Orb design) away from the heatsink's center.



Got your northbridge sizzling? Watercooling can help with far more than just CPUs, as this Koolance chipset block shows.

Stylish and useful, the Vantec Nexus Multifunction Panel keeps you informed about system temperatures while allowing easy control over the CPU fan speed. When you need more speed, just dial up the rpm rate.

Fan Issues

In the majority of systems, fans are the critical components in reaching a cooling vs. noise compromise. The experts we spoke with all agreed that the most common cooling mistake users make is adding too many fans.

"People think that the more fans you install, the better the cooling," says Han Liu, Antec product development manager, "but that's not necessarily the case. Just putting in more fans may not help airflow. However, it will significantly increase your noise."

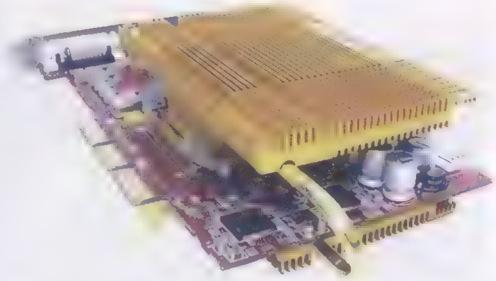
Part of the problem is measuring the air-moving capacity of a fan, typically measured in CFM (cubic feet per minute). Common sense says the way to get higher CFM ratings is to increase fan speed, but this also boosts decibels. A more subtle approach is to drop RPMs and increase fan size. The Zalman CNPS7000-Cu offers a terrific example. At 2,400rpm, the 92mm fan kicks out 25dB, and, in 1,350rpm silent mode, a mere 20dB. (A quiet library is generally around 30dB and a soft whisper is about 20dB.)

The most common size of case fans is 80mm. Directron did an interesting study (www.directron.com/directron/noise.html) showing that the audio output range in this category varies from 40.8dB up to more than 60dB, which is considered the level of regular conversation. Specs for Enermax's 80mm UC-8FABRL /3L make a good illustration at this point:

RPM	1,800	2,300	2,800	3,400
Power	2.64W	3.12W	3.6W	4.2W
CFM	26.87	33.23	36.76	41.77
Noise (dB)	26.5	29.8	30.1	38

It might seem obvious to just make all your fans huge to keep rpm speeds down, right? Maybe, but you'll need to work for it. Most tower systems come predrilled for 80mm case fans, even in series such as Antec's Specialty and Thermaltake's Xaser III, which are designed for gamers. Above 92mm fans, though, there are 120mm and even 127mm (5-inch) designs. About the only place you might fit a 5-inch diameter fan in a tower would be on the top or side panel—which naturally isn't to vendor-recommended spec and will require modding tools.

Elegant, efficient, and big enough to hold your morning Wheaties, the Zalman CNPS7000-Cu is at the pinnacle of modern high-dissipation, low-noise heatsink design.


When you need maximum frame rates, few cooling options can beat Zalman's weighty Z80MA-HP heatpipe aluminum heatsink.

But even when you settle on fan sizes and CFM ratings, there's still the matter of bearing-mechanism quality.

"There are two kinds of case fan bearing structures," says Liu. "One is called 'ball bearing' and the other is 'sleeve bearing.' Usually, saying 'ball bearing' means a dual structure, where you have two ball bearings in the fan. Some fans, though, are single-ball bearing, which means the other side of the fan is sleeve bearing. This is meant to bring the cost down, but it isn't going to help extend the life of the fan."

Sleeve-bearing fans not only tend to lose their lubrication more quickly to evaporation, but they also perform increasingly poorly versus ball-bearing mechanisms as heat increases. Once the lubrication is gone, the axial fan will lock up and the chip underneath will overheat. Some experts also point out that the noise problem with fans is about more than rotation speed and fan-blade size.

"With anything that spins and moves air, you're going to get lift," says Thomas Harkins, vice president of marketing for Fanner Group, which owns Spire coolers. "And that causes vibration in the housing, which creates noise. So unless you balance that fan and eliminate the vibration, fans are never going to be quiet."

Case & Airflow Issues

One thing you'll quickly find is that cooling vendors often have little regard for Intel or AMD guidelines. For example, AMD's System Cooling Guidelines show that the optimal way to cool a chassis is to locate an 80mm or larger exhaust fan below the power supply (approximately over the motherboard's port connectors near the processor) and to place an intake fan at the bottom of the case's front plate. A PSU should have an intake fan on its bottom so as to draw air directly off the motherboard. (To minimize dust in your case, use a filter behind your intake fans. Even the cheap fabric that covers home speakers would serve well enough.) Thus, cheaper PSUs that only use a grille at the unit's front aren't doing you any favors.

Another potential trap many power users fall into is overstuffing a chassis. If you have a hot AGP card, try to avoid putting a PCI card next to it. Similarly, leave air space between your hard drives, especially if they're 7,200rpm or 10,000rpm models.

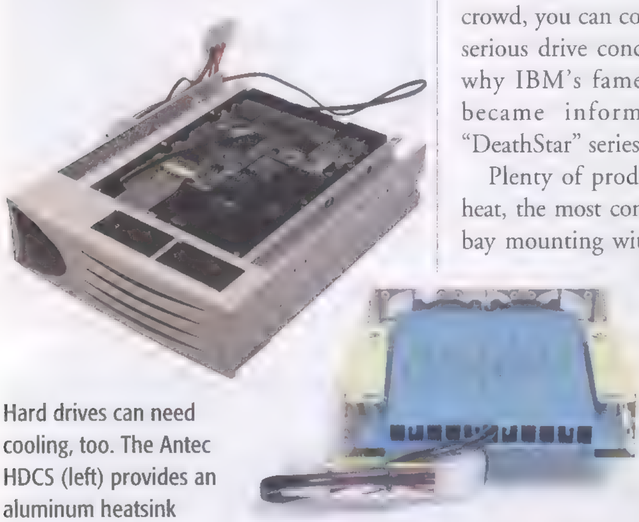
Determining proper airflow is also tricky. Liu notes the only way to accurately test airflow within a chassis is to send the box to a lab for testing. Additionally, the airflow a given fan configuration provides will change as you add components. Obviously, a full-length RAID controller is going to disrupt airflow far more than a stubby network card. (To those who criticize integrated motherboards for supposedly inferior performance, consider the airflow advantages in dispensing with practically all your PCI cards.)

Cabling is another killer. Those wide IDE, floppy, and SCSI cables can disrupt even the best case-fan airflow designs. If heat is a problem, try using round cables, definitely make ample use of zip ties, and keep cables as far away from the optimal jet stream flowing through your box as possible.

One of the most insidious heating opponents is dust. We've all seen systems packed with bulging dust bunnies and thick layers of detritus coating everything from the PCB to the power supply's fan blades. Dust on a heatsink's blades can heavily impact the metal's ability to dispel heat. Dust can also clog moving mechanisms, causing your fans to fail prematurely.

To combat dust, take a can of compressed air to your system at least once a year and blow out the PC's nooks and crannies, particularly in the power supply, fans, and heatsinks. Another good tip is to perform some fine-tuning with your case fans.

"You want equal or positive pressure in your case," says Bill Morales of PCToys.com. "Negative pressure just means you've got air trapped inside that can't escape, and that lets dust accumulate. You can add up the in and out CFMs of your fans, but the trick of the trade is to find a perforated hole somewhere in the case that's not around a fan and put a lighter up to it while it's running. If the flame goes away from the hole, it's positive, and if it goes toward the hole it's negative."


Hard drives can need cooling, too. The Antec HDCS (left) provides an aluminum heatsink (underneath the drive) and LED temperature readout. The StarTech.com Ultimate Hard Drive Cooler is a simpler design featuring a heatsink with two 40mm fans.

And The Rest

Of course, CPUs aren't the only heat-generating components in your system. When you overclock your memory, your north bridge cooks, too. When you need faster fill rates, your GPU starts to sizzle. Both of these chips now generally come with dedicated heatsinks and fans, and the qualities that go into a smart CPU heatsink setup apply here, as well. You want dual ball-bearing fans. Copper isn't as much of a priority on the north bridge, but modern RADEON and GeForce owners hell-bent on maximum overclocking may want to check out a third-party copper heatsink, although even some aluminum designs, such as Zalman's impressive ZM80A-HP VGA Heatpipe Cooler, will do nicely. (Anti-noise buffs should note that this is a passive cooler.)

With 5,400rpm hard drives, thermal dynamics was rarely an issue. Heat started to become a problem with 7,200rpm RAID stacks, and now that 10,000rpm drives appear headed for the performance crowd, you can count on heat becoming a serious drive concern. After all, heat was why IBM's famed DeskStar line once became informally known as the "DeathStar" series.

Plenty of products address hard drive heat, the most common being a 5.25-inch bay mounting with a pair of 40mm fans in the front that blow cool outside air across the surface of the hard drive. Antec's Hard Drive Cooling System takes this a couple steps further by building a broad aluminum heatsink into the bay mounting, using two integrated temperature sensors to feed disk and case temperatures to a built-in LED readout, making the fans variable-speed, and designing the fan filters to be easily removable and washable. You should still try to leave bay gaps between drives, but when you have a hot model in fairly regular use, this is one of the best ways to chill it.

Just as there are times when your drive is naturally cooler because you're using it less, there will be occasions when your CPU, GPU, and other components can also take a breather. In these down times, you don't need the noise of system fans working harder than necessary. This where fan devices come in handy. One of the most famous units in this field is Macpower's DigitalDoc 5. Although a bit bland cosmetically and only featuring one 40mm fan, this bay-mounted device uses up to eight temperature sensors and fan controls to let you configure the temperatures at which each fan should turn on.

The trouble with the DigitalDoc 5 is that it lacks a rheobus, so fans are either on or off. If you want more control and are happy with the temperature reports coming in from an app such as Motherboard Monitor, consider a four-channel controller, such as Vantec's Nexus NXP-201. Available in black or brushed metal, it also mounts into a 5.25-inch bay and simply features four large, blue LED-outlined rheobus knobs. Whereas some rheobus devices require you to cut and splice fan power cables, the NXP-201 offers a regular fan connector behind each knob and a standard four-wire Molex connector to power the lot. The NXP-201 can control just about any system fan, but we find it particularly useful for case fans because this is where much of the system's decibel-output originates.

If the CPU fan is your main worry, try Vantec's Nexus NXP-101. This bay-mount device features an LED display for its CPU, hard drive, and case temperature sensors, as well as CPU fan speed, but the single, oversized rheobus knob only controls the CPU fan. If the CPU fan fails or the chip starts to overheat, an alarm sounds. Vantec includes dark blue, green, and purple translucent faceplates, although smoky gray, lime green, and clear (for viewing the underlying brushed aluminum) are also available in an option pack. We also like that the NXP-101 features two front-mounted USB 2.0 ports and one FireWire port.

There's no real end to cooling options. Some (arguably unstable) enthusiasts have even resorted to liquid-nitrogen cooling, which can drop a CPU to under -300 degrees Fahrenheit, never mind the risks that accompany handling liquid gas. We contend, though, that if you pay close attention to the specs, placement, and component quality in your heatsinks and system fans, you can achieve more-than-adequate cooling results with substantially less noise output than one would normally expect.

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by William Van Winkle

(To read our "Just How Hot Is It?" sidebar on measuring your system's temps and our "Water It Down" sidebar on watercooling solutions, subscribers can go to www.cpumag.com/cpujun03/cooling.)

PERFORMANCE & OVERCLOCKING MODS

Fine-Tune Your Rig For Maximum Velocity

Perhaps you're the type who likes to squeeze every possible clock cycle out of your Pentium 4 or Athlon XP processor. Or maybe you're a pixel-shaded, anisotropic-filtered, 3D-gaming ninja who needs to have the fastest 3D graphics card on the planet: You'll upgrade your video card every six months, even if you don't need to. In any event, one of the main attractions of performance personal computing is building a machine yourself and tweaking it until it purrs like a well-loved kitten.

The custom-built PC has evolved into a highly customizable, feature-rich machine that is capable of serving many more applications than ever before. Here we'll give you details on some of the best-known performance and overclocking modifications that you can implement in your own machine to bring out the power within and tune your rig for maximum performance and return on your investment in processing power.

Initial Considerations

Before we dig into nitty-gritty overclocking and tweaking information, there are a few prerequisites you'll need to meet in order to have the best likelihood of overall success in your efforts. First of all, we'll give you a quick acronym here: CARP. We're not talking about the butt-ugly fish species; in this case, CARP stands for CPU cooling, Airflow, RAM, and Power. Anyone looking to maximize PC performance needs to make sure these key areas are covered with good quality equipment. That means you'll need a quality case with good ventilation, a decent heatsink and fan assembly on your processor, and a solid power supply with good, clean regulation and high output. Although an in-depth discussion of these components is beyond the scope of this article, you can get information on them in the articles on pages 52 and 56 in this issue.

Once you have a quality basic system, you're ready to tackle some performance tweaks. But first, a couple of small disclaimers: We're going to cover what we consider to be the most widely used types of system configurations on the market today. That is to say, we're going to concentrate on Intel Pentium 4 (specifically the Northwood version) and AMD Athlon XP (Thoroughbred and Barton cores) systems. However, many of the methods and mods we'll discuss here are very much applicable, with a little common sense, across different platforms and architectures.

In addition, many of the methods we'll discuss in this piece could either void your warranty or run things out of spec, sometimes way out of spec. Regardless, we're confident that many of you are more than comfortable crossing into this territory, so we won't dwell too much here, other than issuing the standard "cover your butt" statement and, of course, the oh-so-overused "your mileage may vary." With that said, let's get on with it.

Overclocking & BIOS Tweaks For The Northwood P4

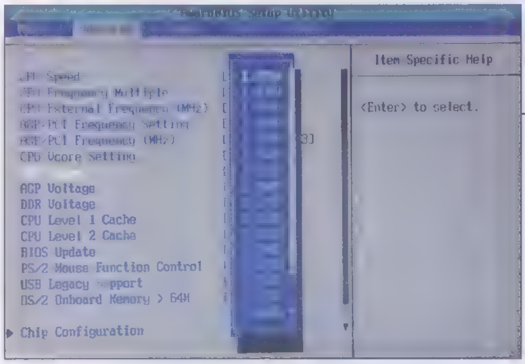
Intel's most current Pentium 4 core, code-named Northwood, comes in a bunch of flavors and speed bins with both 400MHz and 533MHz system buses. From the 1.6GHz version with a 400MHz system bus to Intel's high-end 3.06GHz chip with a 533MHz system bus, all Northwoods come with 512KB of on-chip L2 cache and "locked" multiplier ratios that will somewhat limit your options with respect to overclocking the chip. For example, a 2.26GHz Pentium 4 comes with a locked 17X multiplier, and the only way you are going to take it higher is by turning up its 133MHz FSB (frontside bus) to 150MHz or more.

P4s have a quad-pumped system bus, which is four times the base FSB. (The FSB and system bus are essentially one and the same; they are clock multiples of each other.) So whatever you take that base speed up to, you'll be overclocking the system bus by the increment times four. In this case, a 150MHz FSB will yield a 2.55GHz clock speed (150MHz x 17) for the CPU and a nice neat 600MHz (150MHz x 4) figure for the system bus. For examples of Pentium 4 Northwood cores along with their clock, multiplier, and frontside and system bus speeds, see the "Pentium 4 Cores" sidebar.

Your P4's vital stats will be etched on the front of the chip: third line down from the left is the CPU speed, cache size, system bus, and core voltage. Learn how to identify a Barton core on page 62.

Incidentally, by the time you read this article, Intel will have released a new Northwood CPU, based on an 800MHz system bus (200MHz FSB). But because we want to keep things manageable for you here, we'll work with the current mainstream Northwood variants for this article. Now that you've had a look at some of the speeds and feeds available to you, let's boot up, enter the BIOS, and show you how to dial them in.

Enter the BIOS. Entering the system BIOS is easy. You can usually access the BIOS on almost all motherboards by pressing the DELETE key during initial bootup. Once in, you'll be presented with a number of screens that you can toggle through with your arrow keys. If this is completely foreign territory for you, you might want to consult someone who knows how to get around this area. You can easily go down the proverbial rat hole if you're not sure what you're doing.

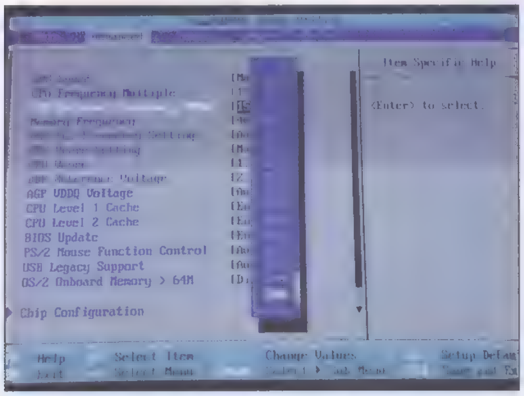


```
Item Specific Help

<Enter> to select.

CPU Ucore Setting

AGP Voltage
DDR Voltage
CPU Level 1 Cache
CPU Level 2 Cacha
BIOS Update
PS/2 Mouse Function Control
USB Legacy Support
OS/2 Onboard Memory > 64M

▶ Chip Configuration
```

You'll want to try to find a happy medium between heat and voltage in any effort to achieve a stable overclock.

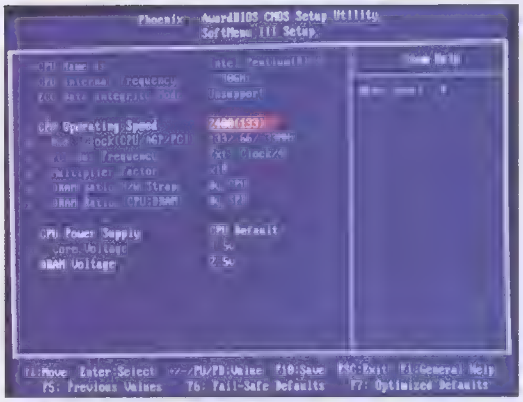
So you're in and bopping around BIOS screens now. Look for the Advanced Chipset Feature menu, CPU Frequency And Voltage Control, or the Soft Menu section, if you are running an ABIT board. It should be fairly obvious to you, and you'll be looking for a screen that looks something like what you see in Figure 1 and Figure 2 below.

From here, things are pretty straightforward. In this menu, there are typically settings not only for the FSB of your CPU but also voltage adjustments for it. You may need to increase the core CPU voltage to achieve stability at your new overclocked speed. Typically, anything over a few MHz higher on the FSB will require a goose in voltage, as well. Remember that more voltage generates heat, so make sure that your CPU cooler is up to the task and that it is interfaced well with the processor. If the processor gets too hot, it will be unstable.



```
Item Specific Help

<Enter> to select.

CPU Frequency Multiple
Memory Frequency
AGP VDDQ Voltage
CPU Level 1 Cache
CPU Level 2 Cache
BIOS Update
PS/2 Mouse Function Control
USB Legacy Support
OS/2 Onboard Memory > 64M

▶ Chip Configuration

Help      Select Item      Change Values      Setup Defau
```

Figure 1



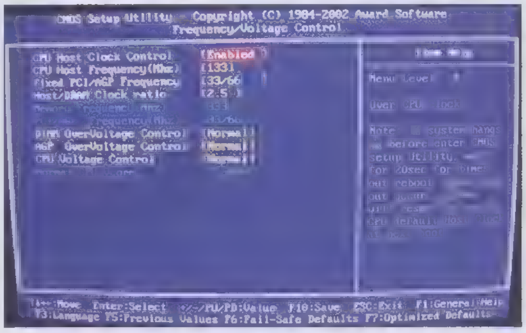
```
Phoenix - AwardBIOS CMOS Setup Utility
SoftMenu III Setup

CPU Operating Speed           2400(133)
CPU Power Supply              CPU Default
DRAM Voltage                  2.5v

F5: Previous Values    F6: Fail-Safe Defaults    F7: Optimized Defaults
```

Figure 2

Memory concerns. So you have now changed the clock speed of the processor, but you need to remember that you've also changed the FSB speed and system bus. This change will also affect your system's RAM, and depending on how far you've gone, you may have to adjust things there, as well. Because all P4 boards derive their memory bus speed from the FSB, there is a simple relationship that you'll need to understand, but it varies among motherboard chipsets. Early versions of the i845 chipset, for example, support 266MHz DDR DRAM (133MHz FSB x 2). The i845PE supports DDR333 (133MHz x a 2.5X multiplier). The i850E chipset (RDRAM-based motherboards) multiply the FSB times four and then clock double it. So, 133MHz x 4 = 532 x 2 = 1,064, or what's commonly known as a PC1066 RDRAM speed. Take your FSB up from 133MHz, and you can do the math.

By now you're getting the picture that if you push the FSB higher in an effort to overclock the processor, you'll need to consider at what speed you'll be running your memory. Some mobos that support CPU overclocking also support changing the multiplier of your memory, so you can either clock the memory back to spec or overclock it. Of course, higher memory speeds mean more system memory bandwidth, which is also nothing but goodness.

So going back to our 2.55GHz (2.26GHz P4 at 150MHz FSB with 17X multiplier) CPU overclock, if you set the FSB to 150MHz on an i845PE-based board, the memory will be running by default at 375MHz (150MHz memory bus speed x 2.5X multiplier). This is an example of a 2.5:1 ratio off the FSB speed. You can then adjust your multipliers or ratios from there. Many boards offer ratios vs. multipliers to calculate the memory frequency. So make sure you understand what you are dialing in. The users manual (we know, perish the thought) is a good place to look for this information. Some boards will even let you dial in even higher multiples. Because PC3200, or DDR400-capable, memory is very much mainstream these days, higher memory speeds shouldn't be a problem and will only offer increased memory bandwidth to support your P4 overclock.



```
CMOS Setup Utility - Copyright (C) 1984-2002 Award Software
              Frequency/Voltage Control

CPU Host Clock Control        [Enabled]
CPU Host Frequency(Mhz)       [133]
Fixed PCI/AGP Frequency       [33/66]
Host/DRAM Clock ratio         [2.5]
DIMM OverVoltage Control      [Normal]
AGP  OverVoltage Control      [Normal]
CPU Voltage Control

↑↓→← Move  Enter:Select  +/-/PU/PD:Value  F10:Save  ESC:Exit  F1:General Help
F3:Language F5:Previous Values F6:Fail-Safe Defaults F7:Optimized Defaults
```

Here's an example of memory clock multipliers in the BIOS.

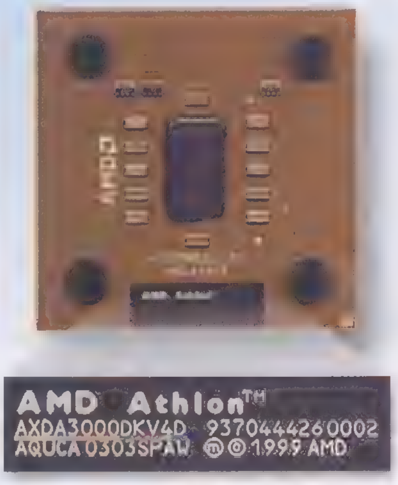
Finally, many BIOS programs will also let you adjust voltage for your memory. You guessed it: As a general rule of thumb, slightly higher voltages can equate to more stable memory overclocking. However, tread lightly here. Often times, you can reach a point of diminishing returns because the additional heat generated can cause instability. One or two tenths of a volt over the standard 1.5V setting for DDR memory is usually enough. Again, motherboards vary greatly in the areas of memory timing and adjustments. So keep your eye on the boot screen when you try a new setting, and if things go blank, don't assume it is your processor that is not handling the overclock. It could very well be the memory settings you are working with, which are derived from the FSB.

Overclocking your processor can yield measurable performance gains, on the order of 10% to 40% and higher, depending on how far you take things and how aggressive you are with cooling methods. Now that you've had a glimpse of the world of Pentium 4 Northwood overclocking, let's look at it from an AMD Athlon XP perspective.

Athlon XP Overclocking & Modification

The overclocking process for Athlon XP processors is very similar to that of the Pentium 4, with one notable exception. Like the Pentium 4, most Athlon XPs leave AMD's fabrication plants with locked multipliers. However, with a little time and a steady hand, there are a few ways to unlock your Athlon, which will let you take the clock speed up a notch or two but with multiplier adjustments, as well as FSB speed bumps. This method adds greatly to flexibility in your overclocking endeavors.

As AMD's Athlon XP has evolved, it has gone through a few different core revisions. Before jumping in here, you may want to take a quick look at the "Common Athlon XP Processors" sidebar to familiarize yourself with the latest ones. The Palomino cores were the first to hit the market, followed by Thoroughbred and then Barton. Palominos and Thoroughbreds are generally the same, but they were built using different manufacturing processes. The older Palominos were built using an 0.18-micron process, while the Thoroughbreds, and now the Bartons, are built using a more advanced 0.13-micron manufacturing process. As you probably are aware, in addition to allowing higher clock speeds, using a smaller die geometry in the manufacturing process lowers the device's power consumption and lets it generate less heat during operation. These are two features that are generally beneficial for overclockers.



Architecture Segment: AXD = AMD Athlon™ XP Processor Model 10 with QuantiSpeed™ Architecture for Desktop Products
Maximum Power: A = Desktop Processor
Model Number: 2500 operates at 1833 MHz, 2800 operates at 2083 MHz, 3000 operates at 2167 MHz
Package Type: D = OPGA
Operating Voltage: K = 1.65 V
Die Temperature: V = 85°C
Size of L2 Cache 4 = 512 Kbytes
Advanced Front-Side Bus: D = 333

Here's how to identify a new Barton core from AMD.

Source: AMD

Unlock it. If you're overclocking your system, cooling is everything. When selecting a cooler, please keep in mind that the Athlon XP core is notoriously fragile. So, not only will you want a decent cooler, but we'd recommend purchasing a nonconductive shim to go with it. Before actually mounting your cooler, though, you may want to take a few extra steps to unlock your processor. With a locked processor, the process for overclocking an Athlon is virtually identical to a P4. Enter the system BIOS, bump up your core voltage and FSB, and you're done. Unlocking your Athlon is preferable, however. By unlocking your processor, you'll also be able to run your CPU with higher bus speeds while staying within the clock speed limits of your particular processor.

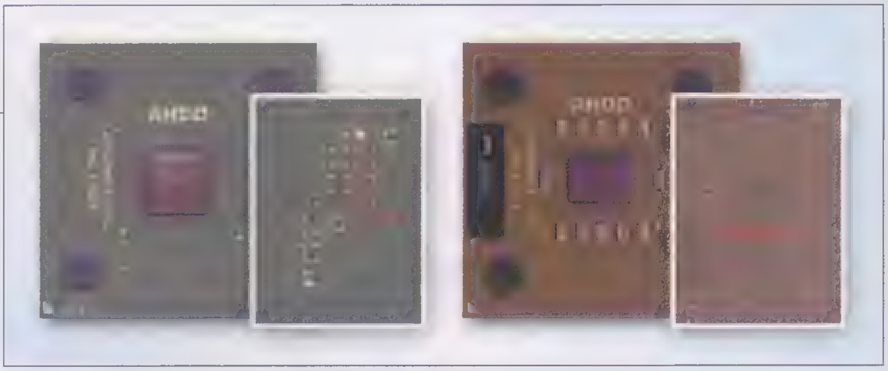
Unlocking Athlons began with the first Slot-A chips. Gold Finger devices were used to dial in multipliers. This method worked through the card edge connectors on the old Athlon cartridges. Then the Thunderbird cores arrived, and the pencil trick was born. For Thunderbirds, connecting the traces labeled "L1" on the top of the CPU with a conductive pencil was all you had to do to unlock the processor. Things have changed slightly with the most recent Palomino, Thoroughbred, and Barton cores, however.

COMMON ATHLON XP PROCESSORS

Because AMD's model numbers don't directly reflect their core speeds, this chart may come in handy as you begin overclocking your Athlon XP processor.

Model Number	Core Speed	System Bus	Frontside Bus	Multiplier	L2 Cache Size	Mfg. Process Technology
3000+	2.167GHz	333MHz	166MHz	13	512KB	0.13-micron
2800+	2.083GHz	333MHz	166MHz	12	512KB	0.13-micron
*2800+	2.25GHz	333MHz	166MHz	13.5	256KB	0.13-micron
*2700+	2.167GHz	333MHz	166MHz	13	256KB	0.13-micron
*2600+	2.083GHz	333MHz	166MHz	12	256KB	0.13-micron
*2600+	2.128GHz	266MHz	133MHz	16	256KB	0.13-micron
2500+	1.833GHz	333MHz	166MHz	11	512KB	0.13-micron
*2400+	2.00GHz	266MHz	133MHz	15	256KB	0.13-micron

* Thoroughbred Core



Here you can see the locations of the proper traces on the different Athlon XPs and which ones you'll need to connect.

Unlocking a Palomino is similar to a Thunderbird, but you will have to take one extra step. AMD burns the L1 bridges, leaving small gaps on the CPU. These gaps need to be filled with a nonconductive material before you can trace the L1 traces. Unfortunately, connecting the traces is also more difficult because you can no longer use a simple pencil. Conductive ink, silver thermal adhesive paste, or an automotive defroster repair kit (the kind used to reconnect a broken etch in a windshield defroster, available at automotive supply stores) are suitable alternatives to the pencil.

With the Barton, AMD made the unlocking process a bit easier. The L1 traces on the Barton are already connected when the CPUs leave the factory. You will need to connect only the fifth trace labeled L3 to unlock a Barton chip. Should you attempt to unlock your processor, it is important not to cross-link any of the bridges. For example, you DO NOT want conductive material connecting the first set of L1 traces to the second set. Should you accidentally cross-link any of the traces, clean up your handiwork and start again.

PENTIUM 4 CORES

You'll need to know the different Pentium 4 Northwood cores and their clock, multiplier, and frontside and system bus speeds when overclocking your system.

Core Speed	System Bus	Frontside Bus	Multiplier	L2 Cache Size	Mfg. Process Technology
3.06GHz	533MHz	133MHz	23	512KB	0.13-micron
2.80GHz	533MHz	133MHz	21	512KB	0.13-micron
2.66GHz	533MHz	133MHz	20	512KB	0.13-micron
2.66GHz	533MHz	133MHz	20	512KB	0.13-micron
2.60GHz	400MHz	100MHz	26	512KB	0.13-micron
2.60GHz	400MHz	100MHz	26	512KB	0.13-micron
2.53GHz	533MHz	133MHz	19	512KB	0.13-micron
2.50GHz	400MHz	100MHz	25	512KB	0.13-micron
2.40BGHz	533MHz	133MHz	18	512KB	0.13-micron
2.40GHz	400MHz	100MHz	24	512KB	0.13-micron
2.26GHz	533MHz	133MHz	17	512KB	0.13-micron
2.20GHz	400MHz	100MHz	22	512KB	0.13-micron
2AGHz	400MHz	100MHz	20	512KB	0.13-micron
1.80AGHz	400MHz	100MHz	18	512KB	0.13-micron
1.60AGHz	400MHz	100MHz	16	512KB	0.13-micron

On to the BIOS. Now you can go into your motherboard's BIOS, and CPU multiplier settings should be available to you to change at will. In addition, with some newer motherboards, particularly ones based on NVIDIA's nForce 2 chipset, a BIOS setting will let users manipulate multipliers without having to modify the CPU at all. Should you be the lucky owner of an nForce 2-based motherboard, browse the Web and see if one of these BIOS files is available for your board.

At this point, you should be cruising along with an unlocked Athlon XP, installed in an "overclocker friendly" motherboard. So what's next? Well, refer back to the beginning of this article and start raising your FSB and voltage until you reach your maximum stable overclocked speed. To truly realize the fruits of your labor, you'll want to run your system and memory bus synchronously at the maximum FSB your memory and CPU can handle, while remaining within the overclocking speed limit of your particular CPU.

For example, let's say that you have an Athlon XP 2400+ (15 x 133 = 2000MHz) that easily overclocks to 2300MHz. You can hit this speed by raising your FSB to 153MHz and leaving the multiplier at 15 (15 x 153 = 2295MHz). If your memory has no problem running at higher speeds, however, you'd see greater performance gains by lowering the multiplier to 12.5 and raising your FSB to 184MHz (12.5 x 184 = 2300MHz). As you can see, the processor stays within its limits, but your FSB speed is significantly increased. Running at the higher bus/memory speed increases overall bandwidth, which will raise performance levels significantly versus CPU clock speed alone. Once again, however, watch that DDR memory clock and make sure it is attainable with good stability. You have to tweak clock ratios here again, as well.

Push Polygons To The Limit

Overclocking and tweaking your processor and motherboard is certainly a great way to tap into extra "freebie" performance. However, now that you have more processing power for work and play, what about the graphics pipeline? There are a few things you can do to wring out additional frames per second from your graphics card. We'll focus on mainstream products here, giving you some techniques you can use on ATI Radeon 8XXX and 9XXX series cards, as well as GeForce 3 and 4 series cards.

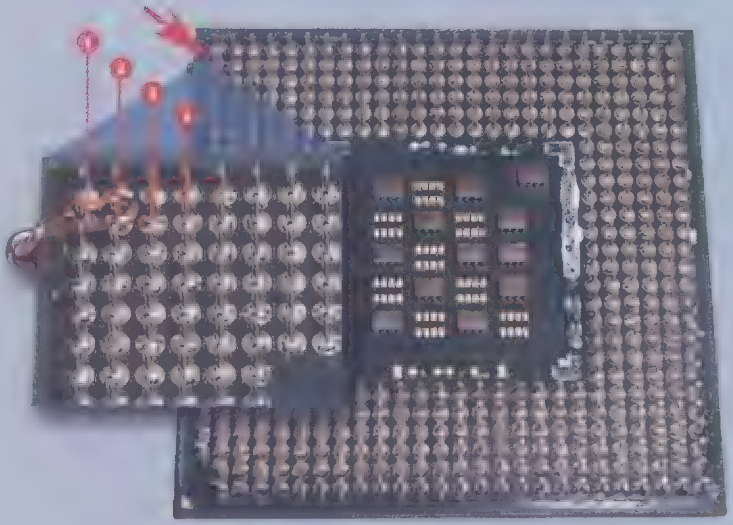
Here again, good cooling methods are the keys to success. Please refer again to our cooling article on page 54 of this issue for more information. Once you're sure that your graphics card is as cool as possible at stock speed, it's time to turn up the clock ticks on your GPU (graphics processing unit) or VPU (video processing unit, as ATI likes to call it).

NVIDIA. Utilities and methods for overclocking with ATI- and NVIDIA-based cards vary slightly. NVIDIA has a Windows Registry tweak called Coolbits. Just do a Web search for this file name, and you are sure to find it for download. What Coolbits does is open a control panel option in NVIDIA's Detonator drivers. This will expose both core GPU and memory clocks for you and give you slider controls on which to adjust them up or down.

The average GeForce 4 card can handle a 25MHz to 50MHz increase in core clock speed and 75MHz to 100MHz (DDR) in memory speed. For example, you should be able to take a GeForce 4 Ti 4200 to about 300MHz to 310MHz core and 580MHz to 600MHz DDR memory, even though the cards ship stock at 250MHz core and 450MHz or 500MHz memory speeds. You can apply this general thought process to other GeForce-based cards; results will vary with respect to top-end clock speeds for each model. The key here is to find your card's happy medium in overclocked performance, with good stability and without graphical anomalies. If

THE P4 VOLTAGE PIN TRICK

If you dare to take your P4 beyond its legal limits, check out this small trick of the trade. Some P4 motherboards do not allow high-enough CPU core voltage adjustments in the BIOS, if at all. However, you can change the amount of voltage that is driven to the CPU by connecting certain pins on its PGA (Pin Grid Array) package. This will effectively tell your motherboard to drive a higher or lower level of voltage to the CPU, and then you can adjust it up or down from there in the BIOS if that functionality is available. Remember, stock voltage for a Northwood P4 is 1.5V to 1.525V, depending on clock speed.



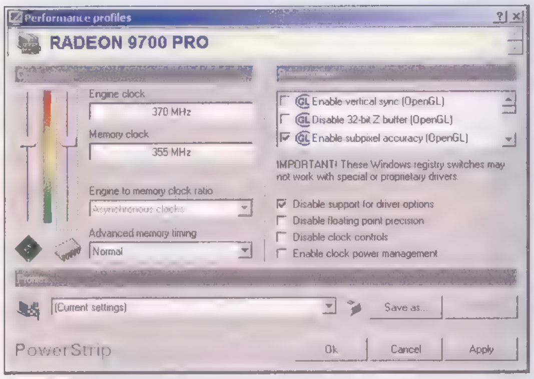
There are 4 pins on the P4 Northwood's 478-pin package with which you can adjust voltage. We'll identify them as VID (Voltage ID) pins 1 through 4 here. Pins, from left in the second row, are VID4, 3, 2, and 1. A "connected" pin has been shorted with wire.

Core Voltage	VID4	VID3	VID2	VID1
1.70V	Connected	Connected	Not	Not
1.75V	Connected	Connected	Not	Connected
1.80V	Connected	Connected	Connected	Not
1.85V	Connected	Connected	Connected	Connected

Notice we're working with the *second row* of pins down on the grid; also notice the orientation of the CPU. The Pin 1 identifier pointer on the processor is the indented row of pins at the bottom left of the picture on the left. Once you have your bearings, you want to twist a thin strand of copper or metal wire into a loop. Stranded single conductor wire, like what is used inside the casing of power supply connector wires, is good to use, but obviously you don't want to rip up your power supply cables to obtain some. Head to a local RadioShack or similar store and pick up some stranded lead wire if you don't have any lying around.

Then carefully loop the wire over the pins you want to connect. The easiest connection setup would be pins 4 and 3, which yields 1.7V. This will tell your motherboard BIOS that your processor needs 1.7 volts. You can often adjust voltage up from there in the BIOS, as well, but BE CAREFUL. We don't recommend anything above 1.85V unless you are working with a watercooling or VapoChill (refrigerant)-type setup. This trick will get you to the 1.7V threshold if your motherboard's BIOS doesn't offer a setting that high or offers no option for voltage adjustment at all. Many times, applying this mod will open up voltages beyond 1.85V in your BIOS, so for you extreme cooling types, this just might be your ticket to paradise.

you've taken things too far, you'll notice screen corruption on your Desktop or in a gaming environment. Flashing textures, popping pixels, and horizontal streaking across your screen are all indicators of a card that is not handling what you are asking of it. Of course, the proverbial lockup is a bit of a wake-up call for you, too.


Performance profiles

RADEON 9700 PRO

Engine clock: 370 MHz

Memory clock: 355 MHz

Engine to memory clock ratio: Asynchronous clocks

Advanced memory timing: Normal

☐ Enable vertical sync (OpenGL)
☐ Disable 32-bit Z buffer (OpenGL)
☑ Enable subpixel accuracy (OpenGL)

IMPORTANT! These Windows registry switches may not work with special or proprietary drivers.

☑ Disable support for driver options
☐ Disable floating point precision
☐ Disable clock controls
☐ Enable clock power management

(Current settings)

ATI cards have no utility in their drivers that you can use to adjust clock timings, but you can achieve the same result by using En Tech's PowerStrip.

ATI. ATI currently has some of the fastest, most feature-rich 3D gaming cards on the market, with its Radeon 9500, 9600, 9700, and 9800 product lines. You can take these cards even higher and reap good incremental performance increases as a result. ATI's high-end 9700 and 9800 cards tend to be conservatively clocked in core frequencies, so they have good headroom for overclocking the VPU. ATI cards have no utility in their drivers to adjust clock timings, but you can achieve the same result by using En Tech's PowerStrip (www.entechtaiwan.com/ps.htm). PowerStrip detects core and memory clock speeds, and you can adjust them accordingly with sliders, as well.

You can take a Radeon 9700 or 9700 Pro VPU clock as much as 60MHz to 75MHz higher than its stock speed of 300MHz or 325MHz, respectively. The stock DDR memory speed of the Radeon 9700 is 580MHz, 620MHz for the 9700 Pro. ATI also uses high-end 700MHz DDR memory, and you can often take it right up to its limit and sometimes slightly beyond. Radeon 9500 cards are a bit of a mystery, however. ATI has intentionally limited this card, it seems. Although you can overclock the core and memory speeds on these cards, there is no appreciable gain in performance that we have witnessed. However, Radeon 9100, 9000, and 8500 cards do indeed benefit from overclocking and also provide good headroom for this.

There are a number of different driver level tweaks you can apply to graphics cards, obviously, which can improve frame rates at the expense of image quality. However, overclocking your graphics card can yield performance gains on the order of 5% to 20%, and you can still keep all the eye candy on.

Keep It Stable

We've talked about checking for stability a little bit, but the topic merits a more detailed discussion. There is nothing more annoying than system crashes and lockups, which completely defeat the purpose of optimizing your system in the first place. Here are a few methods we use to test for general system stability.

First, get yourself a good "health monitoring" program for your motherboard. Some motherboards come bundled with their own utilities, such as Hardware Doctor and PC Probe. Then, of course, there are stress test utilities with such programs as Prime95 (www.mersenne.org/freesoft.htm), SETI@home (setiathome.ssl.berkeley.edu/download.html), and SiSoftware's Sandra (www.sisoftware.net). Prime 95 does a good job of working your processor as it calculates prime numbers.

SETI stands for the Search for Extraterrestrial Intelligence, which is a program that runs a screen saver while your machine is idle, working on data sets from the world's largest radio telescope. SiSoftware's Sandra benchmarking software has a Burn-In Wizard that is also fairly easy to use. You can set it up to stress all of the major components in your system.

Once you feel you have established a stable, overclocked, and optimized system, try these various free or shareware utilities to see if your system will hold up under the strain for a few hours of testing. If it can, give yourself a pat on the back. A little (or a lot) of extra performance for free is a beautiful thing, isn't it? CPU

by Dave Altavilla

IS IT REALLY WORTH IT?

Now that we have sufficiently given you enough knowledge to be dangerous, you're probably asking yourself if all this work and risk is worth it in the end. The answer really depends on your own personal perspective. You have to size up each opportunity and decide whether the potential performance gain outweighs the risk. That's not to say that any of the methods we described in this piece are extremely risky. However, when running your system out of spec, sometimes way out of spec, you need to understand that you're technically pushing the components of your system beyond their stated intended use. As a result, overclocking a lower-end or midrange processor, such as a P4 1.60AGHz or 2.26GHz chip, is a better option than overclocking a high-end processor, in terms of the risk level you are taking, because the relative cost of the CPU is much lower than, say, a 3GHz chip.

Then there are those who ask the question, "Is my system fast enough?" At the top end of processor clock speeds or with a high-end graphics card, your answer may in fact be not to overclock. However, bang for the buck is always high when you take a budget CPU or GPU and push it beyond its limits into the next level performance class.

In the end, you can be the judge of how far you want to push your rig and all that high-tech gear within. That's the real fun of being a computer power user: total control and almost limitless potential. ▲

AN EYE ON AESTHETICS

There's Still Hope For Your Humdrum PC

"Beauty, like all other qualities presented to human experience, is relative," Walter Pater wrote in 1873. Pater almost certainly wasn't writing about PC cases, but the spirit of his message holds true: Beauty is in the eye of the beholder. No matter what look you prefer, there are countless ways to turn your PC into something more aesthetically pleasing than a default beige box.

With computers, there's something hard to resist about running sexy equipment using elegant hardware. For some, looks are as important (or more important) than performance. After all, overclocking brings with it cooling and equipment-lifespan issues. So why not concentrate on your PC's appearance? With a little time and creativity, you can turn any PC into a machine as stunning as it is powerful. The following are some ideas for prettying up your PC.

Case Window

Cost: **$15 to $50**
Usefulness: **A prerequisite for many other not-so-useful mods**
Installation: **Prefab: easy. DIY: tricky.**
Cool Factor: **A portal to your other visual goodies**

When it comes to PCs, beauty isn't just skin deep. Many mods can embellish your computer's innards, but what good are they unless you can see through the case? A side-panel window, usually made of Plexiglas or other durable plastic, can do the trick. Coupled with internal lights or other glowing gadgetry, a panel can be a window to a world of dizzying techno-lust. Be ready for some maintenance, though; if ignored too long, it will be a window to the dust that invariably collects inside the PC.

Case windows come in all shapes and sizes, including this sharp, circular design.

For industrious DIYers, installing a window means cutting a hole in the case's side with a jigsaw or rotary cutting tool, filling the gap with a sheet of clear plastic, and sealing it to the case with rubber molding. You may be able to purchase a new side panel already fitted with a window. These take just a minute to install and won't put your fingers and case at risk under an unforgiving blade. It might take some shopping around to find a side panel perfect for your case, but Frozencpu.com sells a $15 side panel that fits several standard cases, and Directron.com has a $29 panel that fits several others.

Internal Lights

Cost: **$20 and up**
Usefulness: **Sets the mood**
Installation: **Doing it right takes time**
Cool Factor: **Evokes gasps at LAN parties**

A view into a dark PC isn't terribly interesting, so adding a light inside the case is the next step. The standard for PC lights is cold cathode, a type of fluorescent light that's brighter and more compact than neon. Cold cathode comes in several colors and is powered by the PC's power supply. Ultraviolet bulbs are also available; when placed near UV-reactive parts (fans, cables, and other available UV-reactive components), the components give off an eerie, yet cool, glow.

A cold-cathode bulb (a thin glass tube, like the fluorescent lighting that's commonly found in offices) costs about $8, but to get started you'll need a kit that includes a power inverter and wiring. Hookup is straightforward, but mounting the light in a crowded case can be challenging.

Funky Fans

Cost: **$5 to $20**
Usefulness: **Practical and pretty**
Installation: **Not difficult**
Cool Factor: **Cool, literally**

Keeping your PC cool is an absolute necessity, so fans are required. But you can make those fans part of your art. Fans are available in a variety of out-of-this-world hues and styles. You can opt for sleek, industrial aluminum spinners; fans lit with cold cathode; or ones with LEDs mounted on the frame. These fabulous fans aren't any trickier to install than vanilla models, but they are a bit more expensive.

Orange you glad they make fans like this?

Image courtesy of Frozencpu.com

This versatile cable moves electrons, improves cooling, and glows in the dark

Image courtesy of frozencpu.com

Round Cables

Cost: **$6 to $10**
Usefulness: **Lower your PC's temp**
Installation: **Time-consuming if you make your own**
Cool Factor: **Mmmm . . . round**

Long, flat cables for IDE devices and the like have been winding around the inner workings of PCs since time immemorial. Round cables are the modder's alternative and are becoming almost mainstream because, in addition to looking great, they improve airflow. You can make round cables yourself by carefully splicing apart, then bundling, ribbon cables. You can also buy ready-made round cables (typically $6 to $10 each) in a rainbow of colors, including metallic and glow-in-the-dark.

Cable Sleeves

Cost: **$1 to $2 per foot**
Usefulness: **Tidies the place up**
Installation: **Moderately frustrating**
Cool Factor: **Over the top**

To add a little color to your PC's innards and make it look tidier, try cable sleeves. These are tiny, flexible hoses you can wrap around the wires that snake around the computer, such as power supply cables.

Power supply cables won't complain of cold when wrapped in a cable sleeve

Image courtesy of frozencpu.com

Cable sleeves are inexpensive but aren't particularly easy to install. You'll have to remove the Molex plugs from the end of the power supply cable, feed the wire through the sleeve, and then reattach the Molex connector. For more detailed instructions, go to VirtualHideout.net (http://tinyurl.com/8saf).

Front-Panel Display

Cost: **$35 to $175**
Usefulness: **Information easy**
Installation: **If you can install a floppy drive . . .**
Cool Factor: **Spiffy!**

How about filling an empty drive bay with an LCD or VFD (vacuum fluorescent display) on which you can view system temps and voltages, network activity stats, SETI@home progress, or information about networked games?

The display hooks to a PC's serial or USB port and is driven by software that customizes the screen's output. Popular display manufacturers include Matrix Orbital (www.matrixorbital.com), Scott Edwards Electronics (www.seetron.com), and Crystalfontz (www.crystalfontz.com). Software choices to drive the displays are available for Windows and Linux from LCDC (www.lcdc.cc), LCDMax (www.lcdmax.de), and others. Depending on the information you display, this case mod could be useful as well as pretty.

Custom Paint Job

Cost: **Very cheap to very expensive**
Usefulness: **Completely impractical**
Installation: **Tricky and time-consuming**
Cool Factor: **Amateurish to striking**

An LCD like this one puts system stats in an otherwise lackluster drive bay.

Paint can provide a low-tech, high-style way to customize your case. It's also one of the few ways to give your PC a truly unique look. At the relatively simple, cheap end of the spectrum, you can give your PC a new color and sheen armed with a few cans of spray paint. To do the job right, you need to take the case apart, thoroughly clean it to remove oils and other contaminants, and apply a primer coat (to keep the top coat from peeling) before spraying the top color. DIYers can look to www.tinyurl.com/9917 for more details.

SITES THAT CAN HELP

If you're gung ho to start hacking your PC's looks, the following sites specialize in gear that can help.

- CoolerGuys; www.coolerguys.com
- Crazy PC; www.crazypc.com
- The Cutting Edge; www.cuttingedgecasemods.com
- FrozenCPU.com; www.frozencpu.com
- HighSpeed PC; www.highspeedpc.com
- Jab-Tech.com; www.jab-tech.com
- NexFan.com; www.nexfan.com
- VoyeurMods.com; www.voyeurmods.com
- Xoxide; www.xoxide.com
- 1CoolPC; www.1coolpc.com

At the opposite end of the spectrum is the pro paint job done with automotive paint. Falcon Northwest offers such painting with its Mach V Exotix (www.falcon-nw.com/exotix.asp) paint jobs. A single color of metallic, pearlescent, or color-shifting paints can add $400 to a new PC's cost. A custom airbrush job can cost up to $1,000. The Exotix paint is only available on new Falcon systems, or you can have it added to existing Falcon PCs in the proper case type.

You can also try convincing a local automobile body shop to take the job. One shop we asked said it would paint a case and monitor any color we wanted. Estimate: $100 to $125 for the case alone.

Case Badge

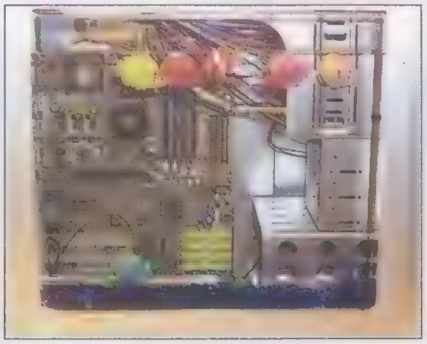
Cost: Cheap
Usefulness: Utterly useless
Installation: Easy as pie
Cool factor: Slightly cool

Most cases have a 1-inch square "badge," which is often the manufacturer's logo. A modder, however, wouldn't leave a "Dell" or "Intel Inside" badge on her case's front any more than a hot rodder would leave a "I Got It At Springfield Toyota" license plate frame on his new car. A new case badge is an easy way to personalize your PC without breaking the budget. Badges are available from PCdecals.com, Thinkgeek.com, and PC Case Gear (pccasegear.com), usually for less than $3 each. If a plain badge is too vanilla, illuminate it with a light kit, which usually includes a LED mounted to a 1-inch square of white plastic, a 4-pin power supply cable, and self-adhesive paper. Simply connect the LED's power cable to a hard drive power connector and drill an installation hole where you want the badge to go. A backlight will shine though a clear badge or provide eerie edge backlighting to an opaque one. Get kits from such sellers as Directron.com ($9) and Crazy PC ($12; crazypc.com).

Lian Li Aquarium Side Panel

Cost: about $100
Usefulness: May calm frayed nerves
Installation: 20 minutes
Cool Factor: The best wet fun you'll find

A particularly unusual and flashy case add-on is the Aquarium Side Panel, which only fits Lian Li (lian-li.com) mid-tower cases. The panel replaces a case's usual side panel with a 1-inch thick aquarium. Just fill it with water, add the included pebbles and plastic fish, and attach it to the case. The kit also includes a cold-cathode light and air pump (for bubbles) to complete the submarine effect. The aquatic landscape doesn't block the view of the PC's innards, so there's a pleasing, yet disconcerting, combination of fish and sensitive electronics.



Something's fishy about this PC.

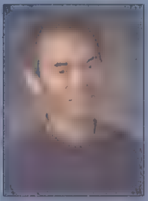
Image courtesy of Overclockersonline.com

And More

This is just the tip of the iceberg—there's no end to the creative lengths modders will go to. You can add glowing electro-luminescent tape to accentuate curves and angles, colored thumbscrews, miniature neon lights, LEDs, and more. In short, your case can have more lights than the Vegas strip or the understated coolness of a jazz club. CPU

by Kevin Savetz

SHUJI NAKAMURA: The Man Who Invented The Blue Laser



You may not know the name Shuji Nakamura, but you probably know his work. Nakamura invented blue, green, and white LEDs, as well as the blue laser. He has been called the Thomas Edison of Japan, and his work with LEDs is expected by many to revolutionize lighting as much as Edison's incandescent bulb did. For now, his efforts enhance the spectrum available to PC case modders.

CPU: How did you come to create blue, green, and white LEDs?

Nakamura: In my previous company, which I entered in 1979, the company's products were phosphors for CRT color tubes and fluorescent lamps. They didn't have any experience in semiconductors at all. I started research to make infrared and red LEDs using gallium phosphide, gallium arsenide, and gallium aluminum arsenide. I tried to catch up with the big companies, but sales of those products were bad because we were a small company. So I made the decision to start new LED research. I started the blue LED research using gallium nitrides—all of the people who were working on blue LEDs were using zinc selenide. I invented the first blue LED at the end of 1993 as a product, and later green and white. The first product of the blue laser diode was released in 1999.

CPU: How did you end up at the University of California, Santa Barbara?

Nakamura: In 1999, I got a job offer from UCLA, so I started thinking about moving to the USA. I met several American professors and asked where the best place for my research would be. Santa Barbara and San Diego were the best places in terms of living, but UCSB was number one in terms of compound-semiconductor research.

CPU: Will white LEDs replace standard incandescent and fluorescent lighting?

Nakamura: Yes, I think so because white LED is now almost compatible with fluorescent lamps in terms of power conversion efficiency, but the lifetime of LED is almost forever. Now we are very close to replacing all conventional lighting with white LEDs.

CPU: What would you like to invent next?

Nakamura: The next generation of high-efficiency, solid-state lighting using a novel structure to increase the efficiency further. Also, ultraviolet LEDs with a much shorter wavelength. But I am too busy getting used to living and working in the U.S. currently.

CPU: What tricks will we see from LEDs in the future?

Nakamura: The color purity of the LEDs is much better than that of current CRT TV. So, using blue, green, and red LEDs, the most beautiful displays for [the] PC could be made soon.

CPU: What's the next hurdle in LED-color technology?

Nakamura: The lifetime of conventional red LEDs is too short. Many customers ask for red LEDs using gallium nitrides, which would last much longer.

CPU: The Blu-ray DVD burner, which is based on your blue laser, is now available in Japan. How do you think the blue laser will change storage?

Nakamura: The Blu-ray DVDs, which have an optical storage density of 27GB, will appear in the market this spring using the blue laser diodes invented by me. Near future, the storage density would be increased to 50GB or 100GB by increasing the output power of the blue laser diodes. ▲

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PC Magazine (August 2002)
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The Bleeding Edge Of Software

by Warren Ernst

GRAPHICS & DESIGN BY SONJA WARNER,
JASON CODR & DAVID FIALA

Inside The World Of Betas

Official product name: ZTreeWin
Version # previewed: 1.49.0n Beta
Publisher: ZedTEK International
Developer and URL: ZedTEK;
www.ztree.com/html/ztreewin.htm
ETA: Q3 2003
Why you should care: Truly, the power user's file manager.

ZTreeWin 1.49.0n Beta

Let's get one thing clear: ZTreeWin isn't for beginners who need to copy a file or two from one folder to another. It's for power users who wish for the return of XTree Gold or Norton Commander, but with the ability to know about Windows' long filenames, the mouse, and virtual screen sizes larger than 80 columns x 24 lines.

If you fill this bill or are willing to do so in exchange for features you may never have known you needed before, it's hard to beat ZTW. Suppose you need to rename hundreds of files in batch across many directories or even several drives? ZTW can handle it. It can also do such things as (brace yourself) edit files in HEX and secure erasing for files or sectors and drives. There's also built-in ZIP and RAR compression/uncompression, file comparison, file and folder hide/unhide, file splitting and rejoining, and of course, file moving and copying. All the commands are completely scriptable, and you can write batch files to streamline repetitive tasks.

The app is small enough to fit on a floppy, but it has the capacity to index 30GB drives, making it perfect for emergency maintenance. Toss in a CD sector, and you have an impromptu backup and restore system.

The beta version requires the main version already be installed, but it adds some new functionality, such as an expanded history list, better error handling, and more scripting commands. The beta is as solid as the main version, and you can use it in a production environment. ▲

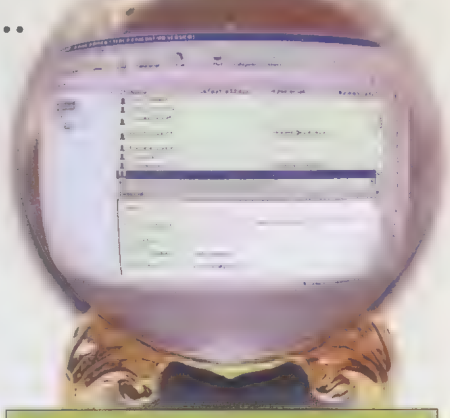
A-book 3.0 beta 4

If your email program doesn't have a decent address book module or the Windows component of a PDA to keep track of your address book, A-book ($29.95; free evaluation) may be for you. And even if you do, A-book has a few nice tricks to see.

A-book's address book per contact listing includes phone numbers (10 business, 10 personal), email addresses (five, five), and snail mail addresses (two); spouse and child's names; birthday and anniversary dates; gender; and nicknames. There are fields for AOL and ICQ screen names and home pages (two). The fields are spread across five tabs in the contact's Properties screen, but a Simplified view condenses the popular fields into one dialog box. The main layout is also attractive, using various colors, fonts, and multiple-line fields.

What really sets A-book apart are its special features, such as its easily print mailing labels or envelopes (more than 100 templates), along with various phone and address or business card-like formats. Want to export your address book to the Web complete with collapsible fields and attractive frames? A-book can do it, and filter it as you need. The app can also dial contacts via your modem and keep a journal of your calls if you like.

Though the program imports/exports data, it's enough of a chore that you'll only want to do it once or twice, but if you don't already have a good address book app, you'll probably never need to do it again. ▲



Official product name: A-book
Version # previewed: 3.0 beta 4
Publisher: Duality Software
Developer and URL: Duality Software;
www.dualitysoft.com/abook
ETA: Q3 2003
Why you should care: Perhaps the best standalone address book anywhere.

YahooPOPs! 0.4.3

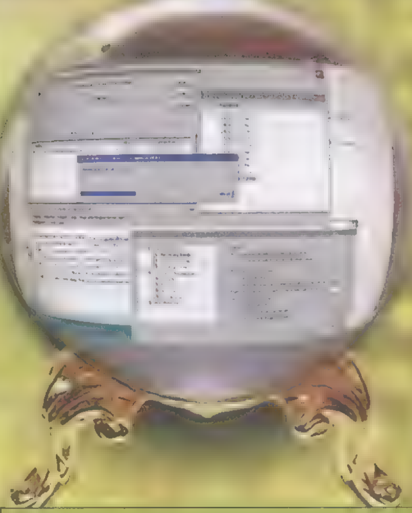
Do you remember when Yahoo! Mail was completely free? The app's basic functionality still is, but in April 2002, Yahoo! removed free POP3 access to Yahoo! Mail mailboxes. To read and write your Yahoo! Mail email with Outlook, Netscape Mail, Eudora, or other clients, Yahoo wanted 10 bucks a month. Many disgruntled users, unwilling to ask their contacts to update their email address books, paid the fee. Others turned to another service. (Hotmail lets Outlook and Outlook Express get mail, for example.) Still others relegated their Yahoo! Mail account to "emergency" status, simply using the somewhat clumsy Web interface when the situation called for it.

Then there are the doers in life who apply their programming skills to a problem. The result of Anuj Seth's and K Shyam's work is YahooPOPs!, now at a very robust 0.4.3 beta. YahooPOPs! works with nearly any email program to let you get your Yahoo! Mail, and it works brilliantly.

YP! acts as a Web browser and POP3 mail server. To Yahoo! Mail, YP! looks like a Web browser—you can even select which browser it identifies itself as—downloading your email messages and attachments, and temporarily storing them. To your email app, YP! looks like a POP3 mail server, delivering your downloaded messages directly into the program's Inbox (or other folders). Once loaded, YP! automatically does its job with no extra key presses.

YP! is extremely configurable. Need it to download only unread messages or folders other than the Inbox, clean out the Bulk mail folder, or automatically delete messages when downloaded? No problem. Need to connect through a proxy or firewall, use MD5 passwords, or connect in HTTPS mode? Ditto.

YP! is available free as an open-source app, and precompiled binaries are available for Windows, Linux, Mac OS X, and Solaris. If you are a Yahoo! Mail user, utilities don't get better than this. ▲



Official product name: YahooPOPs!
Version # previewed: 0.4.3
Publisher: Anuj Seth & K Shyam
Developer and URL: Anuj Seth & K Shyam; yahoopops.sourceforge.net/index.html
ETA: Q3 2003
Why you should care: Free POP access to Yahoo! Mail is always news.

Send Us Your Betas

Know of software in the beta stage that's deserving of some attention? Let us know. We'll take a look at it and possibly give it a go-round. Send your prospects to bleedingedge@cpumag.com.

PhotoMeister 2.0 Beta 19

There's no direct PC equivalent to Apple's wonderful iPhoto, but PhotoMeister comes fairly close in terms of ease of use and even surpasses iPhoto feature for feature. The price is fairly steep ($20 or $40, depending on the features you enable), but there's a 30-day trial to check out all of its features.

PM works with "albums," or groupings of photos. It can grab photos directly from a camera, any TWAIN device, or from folders on your hard drive. Once imported, PM makes it easy to rotate photos; add annotations; adjust color, brightness, and contrast; remove red-eye; and view metadata within a photo's file (such as exposure speed, the camera model, etc.). Navigating photos within albums or jumping from album to album is quick and easy, and although the interface isn't a standard one, it's easy enough to follow.

You can share albums in many ways, including some you may not have thought of, and generate prints in high quality, one photo per sheet via a photo printer, multiple photos per sheet, or a clever montage of photos to a CD jewel case sheet, suitable for CD backups. Speaking of which, PM has built-in software to burn CDs, either with an archive of photos or a self-loading slideshow, complete with an auto-exec file.

PM can also help create a spiffy screen saver and an executable slideshow without a CD. You can specify the compression rate and resolution of the photos and automatically email albums as JPGs, a Zip file, a collection of thumbnails, or a PDF file (Acrobat isn't required). You can also generate a Palm OS-compatible album, either in color or black and white.

Other programs can do all this, but none that I've used do it all so easily. The beta has more than a few glitches, but there's more than enough functionality, so see if PM is right for you. ▲

Official product name: PhotoMeister
Version # previewed: 2.0 Beta 19
Publisher: Paessler GmbH
Developer and URL: Paessler GmbH; www.photomeister.com
ETA: Q2 2003
Why should you care: A nice PC simulation of iPhoto makes managing photos simple.

UP TO SPEED

Upgrades That'll Keep You Humming Along

Firmware upgrades have been plentiful in recent months; this time around, Plextor and Creative are re-hardwiring some of their devices for optimal performance. And if you didn't upgrade to DirectX 9 earlier this year, here's your chance to use a bug-fixed version.

Driver Bay

DirectX 9.0a

The new edition of the DirectX multimedia API gets its predictable "a" incremental release only a month or so after its premiere. Beyond the usual bug fixes, DX9.0a corrects sporadic malfunctions in multiplayer gaming and running MSN Messenger. Fair warning: DX9 is an irrevocable upgrade; you can't uninstall it. To be safe, use System Restore in WinMe/XP to create a Restore Point before upgrading so you can roll your system back to the previous DX drivers.

Get it at: www.microsoft.com

NVIDIA Omega Drivers 1.4230a

Based on NVIDIA's own recent 42.30 unified driver set, these Omega Drivers are tweaked versions that come in two flavors. One set is designed to optimize the NVIDIA drivers for performance, and the other set is optimized for image quality. Both tuned-up drivers add more resolution settings and options than the standard NVIDIA drivers.

Get it at: www.omegacorner.com

ATI RADEON Omega Drivers 2.4.07a

Like Omega's optimized NVIDIA drivers, these drivers for the RADEON family are based on the latest ATI Catalyst drivers. However, the author has altered settings to increase speed and visual quality in games and add more display options.

Get it at: www.omegacorner.com

Nomad Jukebox Unified Drivers

Got a Nomad? Then get these new unified drivers. They add better compatibility with Windows Media Player 9 software and the Microsoft Plus! Digital Media Edition add-on. The drivers work with Nomad 2, 3, and Zen models, but they are particularly valuable to Zen devices that use a FireWire port. Creative says the drivers can add up to 25% faster data transfers between a Zen and your desktop PC via a FireWire connection. Zen USB 2.0 model owners: While you're at the Creative Labs site, pick up the revised firmware for the unit. It's designed to stabilize and speed up the boot load sequence for this Zen model.

Get it at: www.creative.com

Upgrade Central

ActiveSync 3.6

This incremental update to the 3.5 version's more substantial upgrade adds a new Partnership Wizard, which helps synchronize a Pocket PC with Microsoft Mobile Information Server 2002. This version also claims better syncing with Outlook and over remote (wireless and modem) connections. Microsoft also promises "drastic improvements" in USB connectivity. ActiveSync's ability to recognize a connected PDA via a USB connection has been a source of frustration for Pocket PC owners, us included. So far, USB connectivity seems good in this version.

Get it at: www.pocketpc.com

Flash Player 6 For Pocket PC

This new version will run Flash movies from your Pocket PC. The small download to your Desktop can do an auto install to a connected PPC.

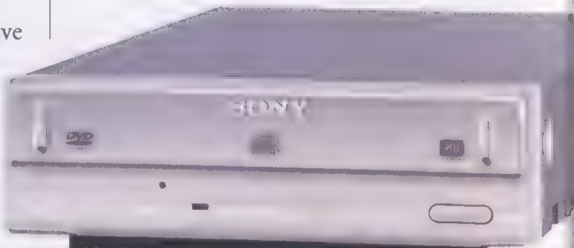
Get it at: www.macromedia.com

Western Digital Lifeguard Diagnostics For Windows 1.0

This Windows version of the Western Digital hard drive diagnostic utility can identify a drive model and serial number and run troubleshooting and repair routines. The software supports internal EIDE models, plus USB and FireWire external drives.

Get it at: www.wdc.com

by Steve Smith



News Hardwires

Sony DRU-500A/DRX-500UL Firmware 2.0e

If you're lucky enough to own one of these dual-format DVD burners, drop that video-editing project right now to download this firmware upgrade. It adds full 4X writing support on 4X DVD+R media and improves DVD-ROM read speeds from R/RW discs.

Get it at: www.sony-cp.com

PlexWriter 48/24/48A/U Firmware Upgrade 1.04

One of the fastest and most reliable CD-RW drives gets a fix for an error message that users experienced when trying to reformat discs in Mt. Rainier (CD-MRW) format. The firmware also improves speed and reliability when writing to Verbatim 16X media.

Get it at: www.plextor.com

by David Braue

InterVideo WinDVD Creator Plus

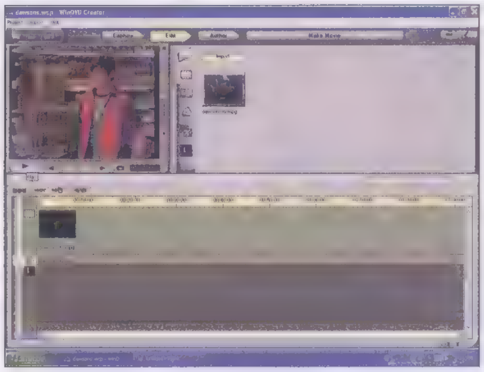
WinDVD Creator Plus tries to do many things and does none of them well. As a video editor and a DVD-burning package, it just doesn't deliver the features needed to make it a leader. It's easy to use, though. Creator Plus eases novices through video editing with a simple interface and a three-step workflow, encouraging you to capture, cut, and burn your video. The app is swift and responsive, even on a low-end Celeron system.

But as a video editor, Creator Plus falls short. You can't split clips, transitions and titles aren't customizable, there are no special effects, and there's only one video track.

As a disc burner, the app is nothing special. It comes with 31 disc templates and turns each clip on the video-editing storyboard into a disc chapter. But you can't create custom menus the way you can with Apple's iDVD or add motion to menus as with Pinnacle's video-editing and burning products. There are two compression settings for DVD but nothing beyond that.

The app can burn discs in DVD±VR format, allowing on-disc editing with DVD±RW media. However, my home DVD player couldn't read the DVD+VR disc I made. (It could read the same physical disc written in ordinary DVD-Video format.) The app also allows Direct Recording if your system is fast enough, piping video from a camera or video capture card directly to a DVD recorder without creating a video file on the hard drive. However, Roxio's Easy CD/DVD Creator does this and more.

Creator Plus is an easy way to quickly move video from a camera or TV onto VCDs or DVDs, but it's underpowered compared to equally priced competitors. ▲



WinDVD Creator Plus
$99
InterVideo
www.intervideo.com

CPU CPU

by Sascha Segan

Pinnacle Instant CD/DVD Creator

Instant CD/DVD Creator is a terrific tool for anyone whose idea of a good time is juggling video discs. The app is actually seven programs with a shared front end: Instant Disc, Instant Copy, Instant Backup, Instant Drive, Instant Write, Instant Music, and Expression.

The most unique function is the ability to easily copy DVDs onto SVCD or VCD with less hassle than with competing products. You supposedly can't use Creator to back up your movie DVDs, as it will choke on the CSS encryption, but freeware programs will turn a movie DVD into a folder on your hard drive. Instant Copy can use that folder as its file source, and you can draw your own conclusions.

Expression, meanwhile, is a slick DVD-burning program that turns MPEG or DV-AVI video into VCDs or DVDs. Editing functions are restricted to trimming, and you can't entirely customize menus, but you have great control over chapter breaks, tweaking encoding options to squeeze more video onto a disc, and creating menus with moving backgrounds.

Instant Drive is packet-writing software that works seamlessly with CD-RWs and DVD±RWs. Packet writing is slow but decent for backing up files. For music CDs, Pinnacle provides a basic WAV editor, a decent MP3/WMA ripper, and a relatively generic disc-burning package.

The second standout part of this package is the automated label creator. Instant comes with a Neato-brand label press, and the program automatically generates professional-looking disc labels, J-cards, and liner notes—turning your homemade discs into great-looking gifts.

Pinnacle's biggest competitor here is Roxio's Easy CD/DVD Creator 6; deciding between the two is tough. Pinnacle offers more control over encoding quality; Roxio offers more flexible menus. Pinnacle creates photo slideshows more easily; Roxio offers more video-editing functions. To copy and create DVDs with professional-looking menus and labels, this is a fine option. ▲

Instant CD/DVD Creator
$99.99
Pinnacle Systems
www.pinnaclesys.com

CPU CPU CPU CPU

by Sascha Segan

CPU Ranking: 0 = Absolutely Worthless CPU CPU CPU 2.5 = Absolutely Average CPU CPU CPU CPU CPU 5 = Absolutely Perfect

by Chris Pirillo

Software To Speed Up Your System—Maybe

*Hi. I'm not here right now, but if you'd leave your name, IP address, and Web site after the beep, I'll get back to you as soon as possible. If you're trying to reach my blog, that can be found at chris.pirillo.com. If you're trying to reach my free series of email newsletters, they can be found at Lockergnome.com. If you're looking for a good time, please hang up and dial *867-5309. Thank you.*

**(Before you start dialing, don't. It's the song title to 1982's "Jennie, [867-5309].)*

Catchy title, eh? Well, I don't need to explain why or how third-party add-ons can improve your personal computing experience. By turning to my column, you've already expressed a desire to enhance your system with super duper software. Either that or you just came to see what kind of goofy stuff I put in my byline this month.

There's no doubt in my mind that Xteq's X-Setup is the ultimate Windows customization tool, but it doesn't do much beyond helping you change Registry settings. For that, I've learned to turn to other tools. Finding these gems proved to be a challenge, though. I'm picky when it comes to adding a new utility to my arsenal. I tend to favor apps with clean Explorer shell integration, only because that puts me one step closer to doing something I want to do (when it comes time to do it). There's also something to be said about all-in-one titles that can replace several separate software solutions in one fell swoop. Are you ready to tweak? Well, then take that Krispy Kreme out of your mouth and get to your keyboard.

> **When there's a Restore button in plain sight, what have you got to lose?**

When I saw the screen shots for MindSoft Utilities XP ($35; mindsoftweb.com), I was in love. In one suite, I can speed up access to programs, run hardware diagnostics, encrypt and permanently erase data on my disks, defrag my RAM, and much more. The tools (indeed) work as advertised. However, it's obvious that the programmer isn't using English as his or her native language. I found the grammatical and syntactical mistakes too frequent to forgive. You may not be as judgmental; if that kind of thing doesn't bother you, I'd recommend trying the 30-day demo.

Ironically, I received a press release for SpeedUpMyPC ($30; www.liutilities.com) not long after I decided to write this column. The app promised to help manage CPU and memory resources more efficiently, manage apps that launch on startup, and recover smoothly from errant app crashes. Its bandwidth optimizer was icing on the cake. In less than a minute, my network settings were automatically detected and changed accordingly. I didn't have to intervene with any part of the process, and I was fine with that. There are certain things I just don't care to know about. If doing something makes something else run faster, I'm all for it. When there's a Restore button in plain sight, what have you got to lose?

There was nothing up my sleeve—even after I installed MagicTweak Utilities 2003 ($30; magictweak.com). I expected more-than-a-somewhat-enhanced software uninstaller, barely-useful startup organizer, and cut-and-dry process killer for the price. I guess slapping an aqua-like title bar on a app makes it worth the money? I found Process Explorer (free; sysinternals.com) and Startup Delayer (free; r2.com.au) to be formidable contenders, especially since they didn't tax my wallet and offered more functionality than this prestidigital package.

I can't remember the last time I ran a Registry cleaner. I've always been leery of anything that portends to remove what it believes to be unimportant. The JV16 PowerTools (free; jv16.org) changed my mind. This amazing little cache of tools includes a very intelligent Registry data parser that provides direct access to the most frequently used sections of your system's soul. The integrated "file tool" also packed a lot of punch, enabling me to search for duplicate files and/or broken shortcuts. The author is working on adding features to the next revision, and I can only believe he'll make 'em just as indispensable as the ones he's given us today.

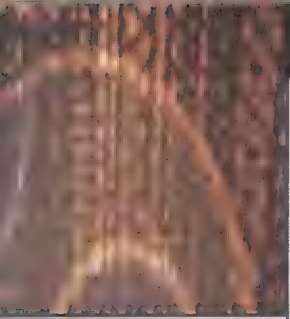
This month's "Why didn't Microsoft think of this" award goes to ShellToys XP ($31; shelltoysxp.com). It seriously puts even a fully customized Send To menu to shame. From a context menu, you'll have immediate access to context-sensitive assistants. Issue an extended search and replace command, view and change a file's extension, mask files by type, and have 30 other great task accelerators at your disposal.

Wow. Can you believe I got through this entire article without mentioning anything from Symantec? There's a reason for that. ■

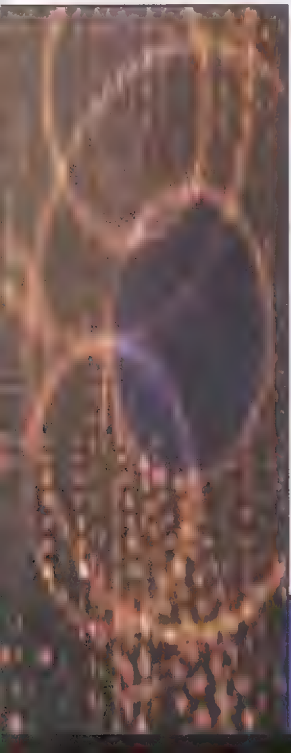
Dialogue with Chris at chris@cpumag.com.

by Pete Loshin

The Free Digital Darkroom



Pete Loshin, former technical editor of software reviews for Byte Magazine *(print version), writes about Internet protocols, among other things. He has been Microsoft-free since 2000 and Internet-connected since 1988. His latest book, "TCP/IP Clearly Explained" (4th edition), is available at your favorite bookseller.*



Let's face it: Serious photography costs mucho dinero. You could throw thousands at your local camera seller for cameras, lenses, flashes, filters, and bags to carry it all. Double that to outfit a darkroom (if you have the space, that is). Plus $20/roll for film, processing, and printing.

Serious digital photography can be just as pricey. It's easy to max out your plastic on professional digital SLRs, drum scanners, and super-quality printers. So the cost of software might be just a drop in the bucket.

But deep pockets and the latest shiny Nikon pro outfit alone won't make you a photographer. If you're willing to buy last year's models or used equipment—and use free software—you can get serious on the cheap. Thrifty shutterbugs can find a scanner, digital camera, color printer, memory, and reader for $1,000 (or less).

The GIMP (GNU Image Manipulation Program) saves the $600 you'd otherwise spend on Adobe Photoshop. Not only is it free, but you also can get versions that do Windows and Mac OS X, as well as Linux/*NIX. According to GIMP fans, you get 90% of the functionality of Photoshop; so far I've had no problems getting what I need from it.

> **But deep pockets and the latest shiny Nikon pro outfit alone won't make you a photographer.**

Though it probably works best on *NIX, you can buy WinGIMP on CD (less than $40; www.wingimp.com) and MacGIMP (less than $30 for Mac; www.macgimp.org). If you dig around the GIMP Web site, you can download it yourself free. Most major Linux distros include GIMP, but check gimp.org anyway for cool links and more info.

Wanna read a good book about using GIMP? Download the popular "Grokking the GIMP" by Carey Bunks from Gimp-Savvy.com or "Gimp: The Official Handbook" at manual.gimp.org. Both books are available in dead-tree editions at your favorite bookseller.

As the official photographer of my extended family, I've accumulated thousands of negatives (some as large as 4 x 5 inches), as well as an assortment of badly beaten up prints, so a film/print scanner was a must, and the Epson Perfection 2450 Photo fit the bill at less than $500. Film-only scanners can be had for half that, though.

Scanning is easy on Linux: Most distros include the SANE (Scanner Access Now Easy; www.mostang.com/sane) API for universal access to any raster image device (scanners, digital cameras, video cameras, etc.) and the XSANE (www.xsane.org) GUI front-end. XSANE plugs seamlessly into GIMP, so scanning is as easy. Just choose on the menu bar File, Acquire, and XSANE Device dialog and wait for the new GIMP edit window to open.

Unless you plan to stay digital all the way and publish only online, you'll need a photo-quality printer. Some vendors, such as Epson and HP, happily support free software users and help developers support their products, while others, such as Canon and Brother, are reportedly less consistently helpful.

To find out which printers will work in Linux, check out the printer database at www.linuxprinting.org, along with great resources for anything to do with printing on Linux systems. You can find Linux-friendly scanners listed on the SANE Web site.

Digital cameras are easy, too. My USB CompactFlash reader plugged and played for me, appearing on my desktop like any other storage device and displaying pictures as normal files. Or you can use Linux-based software; the gPhoto2 Web site (gphoto.sourceforge.net) lists 300 digital cameras that work with gPhoto2, a command-line camera interface with its own GUI front-end, gtkam.

The Web is a great resource for anything to do with photography, whether you need buying advice, tips for better pictures, technical specifications of the latest new equipment, or just a place to see and be seen. Photo.net, a photography community since 1995 or so, is a site where you can join discussions with thousands of other shutterbugs around the world, comment on their work, and ask for critiques on your own.

Check it out, and let me know how it works! ■

Get saucy with Pete at pete@cpumag.com.

by Michael Sweet

Words From The Web

YEAH, THEY ***ACTUALLY*** SAID THIS . . .

From a Yahoo! computer chat room:

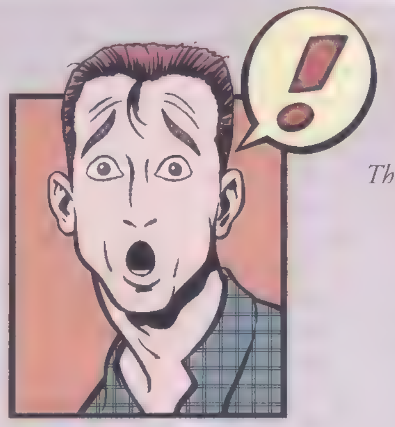
I need some major help with my monitor.

How can you see the chat room?

From an Excite chat room:

When I'm dying at the gym tomorrow, I'm gonna blame you.

Maybe you should blame that 3-pound bag of M&Ms.



From an eBay message board:

What happens If I can't pay for the item I won?

The eBay Police are gonna bust ya.

From an AOL chat room:

I'm sorry I can't fight because I'm on probation for fighting right now.

So that's where you got the black eye, huh?

From an MSN chat room:

I just get the feeling I'm being avoided.

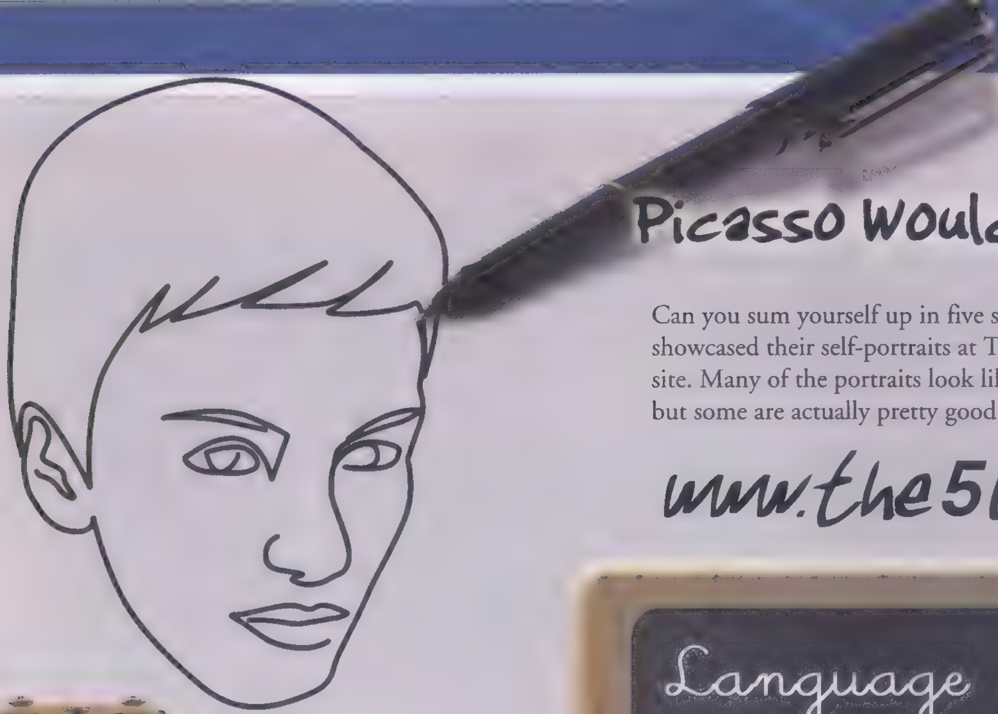
Is that because you're in a chat room by yourself?

Googlefight

Google may be useful for looking up parts for your '84 Mazda, but that's not exactly fun. What good is the world's most powerful search engine if you can't use it for something it wasn't intended to do? Googlefight puts the thrill back in search engines by measuring the popularity of opposite search terms. The process is very simple: Go to www.googlefight.com, type in search term A, type in search term B, and click the Make A Fight! button. Whichever term has the most Google hits wins.

We made several pairs of search terms square off on Googlefight. We were not surprised that the Road Runner once again beat Wile E. Coyote but were shocked to find that Bert took Ernie to school in the competition. We also entered Me vs. The World, and of course we won handily. As always, Good triumphed over Evil.

Googlefight has a Hall Of Fame section for some of the best Googlefights submitted by visitors. Stop by the Fight Of The Month section to see the featured bout. The Classic Fights section pits well-known antagonists against each other, such as Pen vs. Sword and Luke Skywalker vs. Darth Vader. There is also a Funny Fights section that more or less lives up to its name.



Picasso Would Love This

Can you sum yourself up in five scribbles? Lots of people have showcased their self-portraits at The 5 Line Self-Portrait Web site. Many of the portraits look like first graders drew them, but some are actually pretty good.

www.the5line.com

Language Lesson

Don't know the difference between deep bathing and wet cleaning? Keep up with the latest jive at The Word Spy, a Web site devoted to keeping up with the latest trends in word usage. Check out the current list of Top 100 words and the word of the day. You can also search for a word or browse through the archive.

www.wordspy.com

Like Sands Through The Hourglass...

How lonely accountants keep time.

yugop.com/ver3/stuff/03/fla.html

Infinite Loop

Heavy Drinkers Wanted

Developing Windows 2000 must have been thirsty work. According to Microsoft, Win2K's developers drank approximately 4,171,234 lattes before the final build. That's one perk of a location near Seattle.

More astoundingly, one of Win2K's approximately 5,000 developers opened a can of soda every second during its four-year incubation. That's more than 126 million cans of pop. Maybe that's why Windows has long had a Recycle Bin.

Weight Watchers Wackiness

Here's further proof that adults from the 1970s didn't have a culinary clue. This popular Web site posts old Weight Watchers recipe cards touting delicious snacks such as Bean and Mushroom Salad, Frankfurter Spectacular, Jellied Tomato Refresher, and that '70s favorite, Fluffy Mackerel Pudding. All of these foods are guaranteed to make you slim down because no one could possibly eat them.

www.poundy.com/wwcards.html

If you find a strange, interesting, or funny Web site in the course of your Internet travels that you think is worthy of Fringe, send your suggestion to fringe@cpumag.com.

www.BenQ.com

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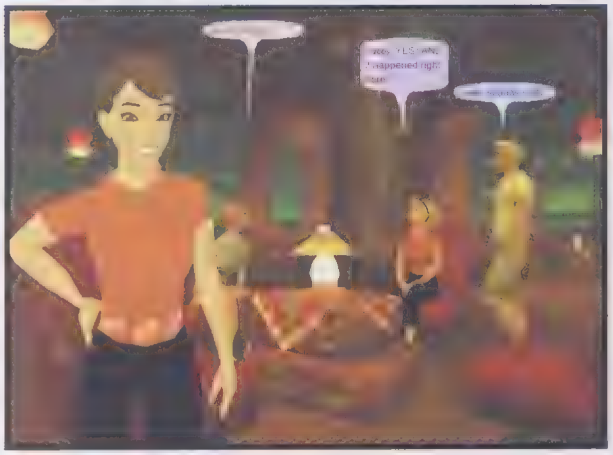
BenQ
Enjoyment Matters

Is There A There There?

Can High-Concept & High-Tech Rekindle The Virtual Community Dream?

Immersive virtual communities? Avatar chats in 3D? Frankly, we've been there, done that, bought the T-shirt, and gone to the comeback concert. Anyone remember how 3D virtual worlds such as The Palace and AlphaWorld were going to revolutionize the Web and have us all conversing in cyberspace piazzas? That you may not remember these projects at all says a good deal about the fate of the virtual community dream. Look at Electronic Arts' hyper-hyped The Sims Online, a virtual suburbia that continues to miss expectations with fewer than 100,000 subscribers.



There's avatars have built-in AI so that they convey humanlike gestures and physical responses to other avatars without a user's input.

The fact is that even at relatively successful graphical communities, such as the U.K.-based teen hangout Habbo Hotel, most chatters meander around featureless rooms muttering "um" and "hi" before strolling away to another facile exchange. But what if you could log into one of four vacation spots, such as a Polynesian island or famous Egyptian landmarks? How about if you could grab a few fast virtual friends and have an impromptu buggy race, hold an antiwar rally, or take a tour of your world via hover boards? Or how about if you decide to earn a living in this parallel universe, so you upload your apparel designs (made in Photoshop) in order to manufacture and sell them to others in this world?

Beta testers are already exploring just these sorts of virtual activities in the prelaunch version of There (www.there.com), a 3D "getaway" where users can explore and build social worlds that include not only communal games and arcade-style activities, but even an economy based on virtual cash called Therebucks. The beta version of There was released at CES in January, and testing is expected to last through June. The consumer version should launch in the third quarter of 2003.

Although There will start as a simple fee-based online world, it is not designed as a game, nor do its makers conceive it merely as a glorified chat room. The master plan for There is to license the elaborate programming and technology to everyone from ecommerce vendors (think avatar-based shopping) to the Defense Department (think simulations of terrorist attacks). So There wants to be everywhere.

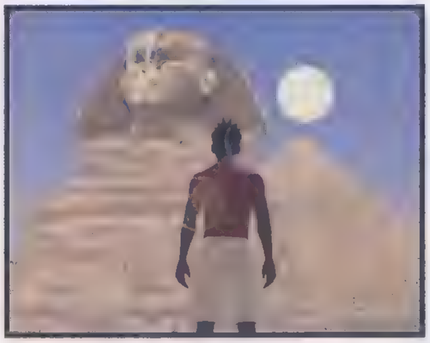
There promises to be the most lifelike and flexible online universe yet attempted. And unlike The Sims Online or Habbo Hotel, the avatars of There don't look like on-screen robots. They can blush and flirt, fidget and wave, and even register responses to things said within the speech balloons that each avatar uses to communicate. The technology and the programming behind this world were five years in the making, involving some of the most seasoned figures in multimedia design, and backed by tens of millions in venture capital. But is there a there there?

A Better World Through Technology

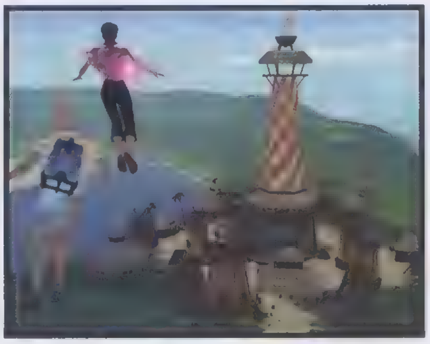
"It's more than 2 million lines of code," says Will Harvey, founder and executive vice president of the programming effort behind his upcoming universe, There. "Operating systems like Windows are in this same order of magnitude in lines of code as our product." Both the client and server applications that constitute There are written in pure C++ because the usual development tools used in multiuser communities (such as Flash MX and Director) can't even dream of handling this level of complexity.

Distributed physics. There is so massive because the company is striving to use technology to overcome some of the perennial problems of online multiuser systems, such as lag time between how two users experience an online interaction because they connect at different speeds. Using what the company calls "distributed physics," the physical actions in the virtual world are simulated on both There's servers and the user's client software so the server doesn't need to send a great deal of information about character or vehicle positioning across unpredictable bandwidth. Because the scenes are being rendered independently on each person's own client software and the server, they have the smooth feel of a video game.

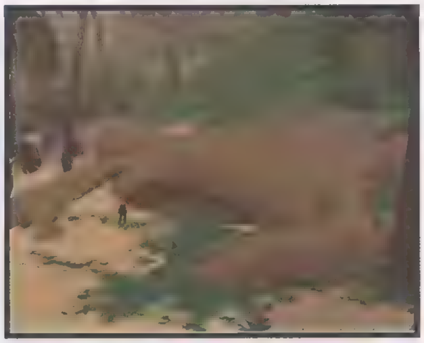
Distributed physics makes this happen by allowing for minor variations in each user's experience of a scene. Heads may turn at different times or one person may be slightly ahead of another at some point in their rendering of a buggy race. Every detail of every scene does not need to be reconciled on both client and server renderings. Only the important ones need to be reconciled. As a result, says Harvey, two avatar drivers may get somewhat different



One of the problems with previous virtual worlds was that people had space but nothing to see or talk about. There worlds, such as this Egyptian tour, give visitors tangible experiences to enjoy or discuss with fellow travelers.



There is not a game, but you can play games in this world. Fun zones will offer arcade challenges for groups, and novel vehicles such as these hover packs let members buzz around local sites.



There is hoping that scenery such as this, along with massive environments to explore, will combine some of the best qualities of massive multiplayer games such as EverQuest with the social tools of a chat environment.

renderings and views of their online buggy race, but that is OK, as long as the experience for each user feels smooth, and the server reconciles the important resolutions of actions. "The technology we have just makes certain that in those critical interactions where you do care that the two users agree on what is on-screen, like who wins a race or whether you hit a person, in those critical interactions people have the same experience," he says.

Keeping bandwidth requirements low could be critical to There's success because the plan is to attract a broad audience of users, not just the hardcore gamers who play EverQuest or the tech-savvy early adopters who experimented with earlier communities. There is promising its world will live comfortably on aging hardware; the program's minimum system requirements are a PIII 800MHz PC with a "recent" graphics card (ATI is a partner), 256MB RAM, and a 56Kbps modem link. Broadband users will be able to communicate with one another via voice input, as well, and even share music and video experiences with friends in-world. For its part, however, the company requires a massive hardware commitment. "Our ratio is 50 to 100 users per server," says Harvey, "so to simulate 10,000 users, you need 100 servers."

AI keeps it real. There needs such muscle because part of the distributed physics model at work here involves an enormous amount of AI embedded in the avatars that both client and server must simulate. One problem with other 3D communities is that the on-screen characters appear lifeless and unconvincing, but to make an avatar seem natural, the user would have to command her figure to do all of the many gestures and ticks we all do unconsciously that make us look human. Harvey's answer is AI. If the avatar is a marionette, "we have to recognize that the user is pulling only one string [basic movement or speech], so we create software that pulls on all the other strings and feels natural and consistent with the string the user pulls."

And so, your There avatar will know to turn and face new people who address you in a room or to gather as a cluster of people who are talking with each other. The avatars will shift legs and arms and adjust body weight to re-create the constant flow of physical fidgets in real-life communication. Perhaps most amazingly, the programmers did a study of certain social graces that make people feel comfortable socially such as providing ample personal space when in a group and making room in a cluster of people for a newcomer. All of these are being put into the client AI, because in order for There to succeed where others have failed in creating a virtual community, "you have to believe that you are your avatar and that other people are their avatar," says Harvey.

Unlike many online multiplayer games, which tend to dominate a user's desktop and resources, There will run in an embedded version of IE6, so users can keep the world running in background and easily switch between its window and their usual Desktop drudgery. This also lets users create and insert their own add-ons. In fact, There will invite ambitious amateur programmers to use There tools, as well as Photoshop, Discreet gmax, and C++ to create new places, clothing, and activities that they can offer and even sell to fellow members.

A There Here

There is no utopian flyer being taken by a bunch of tech innocents, either. The top echelons of this 95-person Menlo Park, Calif., firm are made members of the new media mafia. CEO Tom Melcher was a CNET executive who was also involved in developing daVinci Time and Space, the first virtual community for experimental interactive television in the mid-1990s.

Infinite Loop

4KB Is All Anyone Needs

Remember when 1GB was a lot of hard drive space? What about 4KB? Atari 2600 developers had 4KB of ROM to work with in a cartridge, although special techniques could increase storage space to roughly 32KB. Doesn't seem small? Consider this: an 11-character Word document comes out to 19KB.

Stewart Bonn, whose official title is VP of Fun, was general manager of EA Studios and one of the game behemoth's first employees back in the day. And founder Will Harvey (see the "Up Close With There Founder Will Harvey" sidebar) managed Adobe Systems' media products after running numerous game companies.

There's pedigree is one of the things that has the VCs convinced that there is a "there" here. According to Jim White, managing director, Sutter Hill Ventures, which is in for $6 million, "The There team shares a powerful vision of fundamentally changing the way people interact with each other online." VCs are excited because There isn't just about upgrading The Sims Online. This is about bringing to online life some basic telecommunications and offline commercial activities, everything from conducting phone calls in 3D cyberspace to having virtual business conferences and training.

Earlier this year, company VP for strategic initiatives Robert Gehorsam told *Business 2.0* that he was about to sign a deal with the U.S. Defense Department to build a "virtual Afghanistan" with There technology. Now that is the kind of diverse revenue streaming the big money likes to see, so it is not wholly surprising that in a down market, There succeeded in gathering more than $33 million in funding, including marketing and technology partnerships with ATI, Intel, HP, Levi Strauss, and Nike.

Money maker. What do jeans and sneakers have to do with virtual community? Virtual marketing, of course. The basic revenue flow for There initially will be member subscriptions and the credit card purchase of "Therebucks," virtual cash that you can spend on special items and events in this world. The current exchange rate is 1,787 "Therebucks" to the dollar. But the real money for this company may come in the marketing partnerships. Levis and Nike are already selling digitized versions of their apparel to There beta testers, who use them to further personalize their avatars.

There may also be a vehicle for market testing of future products and even advertising billboards and brand-sponsored events. There wants to exploit the advertising and marketing possibilities inherent in bringing any group of people together, whether in reality or this sort of parallel reality. And all of these brand partners also become marketing and distribution vehicles for There, as well. To get this idea to catch on with a broader audience, the company will need to reach beyond the geek elite and grab the kind of eyeballs you find scanning the shelves at The Gap.

Obstacles remain. Despite its pedigree and clever business model, There still has to vault the checkered history of 3D communities and a persistent unwillingness among general users to embrace the synthetic community concept. Charles Forman, founder of design house SetPixel, looks at projects such as There and its predecessors as suffering from a kind of virtual reality fallacy, the false hope that online exchanges can even approximate human-to-human interaction. "When multiuser applications came out, a lot of people thought there would be applications for everything," he recalls.

But human communications are endlessly subtle, a dizzying blend of the verbal and the physical that we haven't begun to simulate. And as technology advances and we struggle to make apps mimic human interaction, the gulf between face-to-face communication and cyberspace exchanges is more apparent.

"They used to think virtual reality would replace anything," says Forman. "I don't think I've heard the word 'virtual reality' for a long time." CPU

by Steve Smith

Up Close With There Founder Will Harvey

Will Harvey, founder and executive VP at There, seems ready to take the digital world to the next level.

CPU: Other than chat and basic social interaction, what can people do in There?

Harvey: Unlike previous chat worlds, there actually is a lot to do in There. Doing things is a catalyst for conversations and for interacting with people, and not always while doing but after doing. You can have buggy races and paintball fights and make and sell your own clothes. You can rent theater stages and host your own comedy or performance or discussion groups.

CPU: How do I sell a virtual shirt?

Harvey: We give people something analogous to a sewing pattern, a coloring book picture. They submit that to There through the Web, and we review it to make sure it doesn't violate our decency policies or copyright policies, and then we allow them to sell copies of the shirt they created in our auction. It's very much like selling things on eBay.

CPU: But There is looking to extend this technology beyond simply the fee-based virtual getaway concept.

Harvey: It's really easy to imagine that there will be many aspects of our life that can be facilitated in a virtual world, whether it is shopping or going to business meetings or training or museums. There are a lot of things we can do in the virtual world down the line. That said, that is down the line. Many of the companies that have begun with a vision similar to ours, of building a virtual world, have failed in part because they weren't able to focus on their immediate and early steps that were needed to run a successful business. So, we're extremely disciplined about that as a company, so you'll see all of our effort right now is focused on meeting the core need of the user product, which is to let people socialize with their friends and meeting new friends. Really, all of our focus is there. In our road map, the ties to the real world are all applications that will take place in There, and we'll also be licensing our technology. But that's not quite yet.

Connected At 12,000 Meters

Lufthansa's Airline-Internet Experiment

(Freelance writer David Schloss recently flew on Lufthansa's Internet-connected Flight 419 from Washington D.C. to Frankfurt, Germany, to bring CPU *first-hand details.)*

The ritual is all too familiar for business travelers: A mad rush of email, a flurry of downloads, a check of the latest financial data, and a hurried series of instant messages before powering down the notebook and entering the isolated confines of an airplane cabin.

The plane trip—seemingly the last vestige of communication-free existence—is often the curse of the busy professional. As the world passes below, deals are done and plans are still made, but opportunities are often lost—unless you are traveling on Lufthansa's Flight 419 from Washington D.C. to Frankfurt, Germany (or its sister flight, 418 inbound), the first commercial aircraft with always-on high-speed Internet access. Lufthansa is calling the service FlyNet (http://195.126.51.168/flynet).

The result of more than three years of development between Lufthansa and Boeing's Connexion by Boeing division, Flights 418 and 419 were a beta test for a program that's expected to roll out to Lufthansa's international fleet of 80 planes.

The Real Meaning Of First Class

Flights 418 and 419 represent the last test phases of an ambitious project Lufthansa undertook from January 2003 to mid-April to essentially revolutionize air travel. The culmination of more than three years of research, development, and market evaluation, Lufthansa's specially modified Boeing 747s let passengers surf the Web from their seats using their own notebooks. Business class seats were equipped with 10BaseT Ethernet jacks, and several WLAN access points served the rest of the cabin. More than three miles of Ethernet cable connected the seats to a Linux-based server embedded in the aircraft.

A passenger aboard Lufthansa's Internet-connected airplane uses a loaner notebook to take advantage of the company's FlyNet service.

Communicating with a series of orbiting satellites developed and deployed by Connexion by Boeing via a built-in antenna, the aircrafts transmitted data at residential broadband rates despite changes in the plane's speed and altitude and unexpected turbulence. In 2004, Lufthansa plans to fit its entire fleet to provide the same high-speed service, though the company expects to eschew wired connectivity in favor of Wi-Fi for the weight and costs savings.

Lufthansa's press materials often speak of onboard connectivity in conjunction with the advent of airmail. A "wired revolution" isn't Lufthansa's only goal, however. Although Internet access was free on test flights, passengers will pay around $35 for transcontinental access. Lufthansa executives expect passengers will do this in droves, and from all indications, they are likely to do so.

Market research conducted by the International Air Transport Association in 2002 revealed what should come as no surprise: People want to connect online. Research showed that 50% of travelers polled in all classes have a strong interest in in-flight email and Internet access, and three in five passengers would pay for the service.

Boeing's own research indicates that 75% of all European business travelers carry notebooks onboard, as do 62% of U.S. frequent flyers. Six percent of frequent flyers indicated they were extremely likely to switch carriers to obtain in-flight Internet, even if it meant flying on a carrier that's not part of their frequent-flyer program. This might not seem a large percentage, but frequent flyers typically represent an airline's most loyal travelers.

Some business travelers bristle at the thought of being continually connected, worrying that Internet access will force them to work on-flight. Andy Schweiger, senior consultant for Lufthansa Systems Infratec, sees things differently. "My response for them," he says, "is that I'd rather get my work done on the plane and enjoy my last night at the hotel." In other words, get your work done in-air and take time off in a foreign city, instead.

Many Lufthansa airport lounges already have 10Base-T and wireless access points that provide high-speed connectivity to go hand-in-hand with the 2004 rollout of the Connexion by Boeing project. Schweiger describes a future where a business traveler leaves the broadband office, stops at the airport lounge for more connectivity, then hops on a plane for a few more hours of online work or entertainment. Schweiger says the service doesn't have to be exclusively work-based. There's no reason, for example, a carrier couldn't use the broadband

Lufthansa's experimental FlyNet service gave users Internet access via a WLAN or Ethernet connection while in flight. The company hopes to roll the service out across its 80 airplanes in 2004.

network to provide movies and other entertainment. Every passenger could, in theory, select a movie of her choice and watch it on her notebook instead of on a smaller in-seat screen.

Internet-enabled flights are seemingly just another good business move, which Lufthansa is working hard to bring to the cabins of other carriers, as well. Although it might seem counterintuitive for Lufthansa to assist competitors with outfitting their aircrafts, Schweiger says that satellite time and other requirements involved with operating a network of orbital communications equipment is expensive. Each new commercial subscriber helps lower the costs and makes the system more popular. Because the system is pay-per-use for the consumer, more popularity equals more profit.

A Different Scene

The scene aboard a Connexion by Boeing-enabled flight is obviously different than that of other flights. Passengers and crew spend downtime surfing the Web rather than pacing the aisles. Decades ago, international flights were filled with dozens of people smoking cigarettes mid-cabin, but now the planes are filled with instant messages, Web pages, and email.

Lufthansa and Boeing spent years sweating the details of FlyNet. The companies worked with the FAA to ensure that Wi-Fi technology operates without affecting critical systems. Even so, a master switch in the cockpit allows pilots to kill the service at the push of a button.

The onboard Linux-based DHCP servers provided a reliable stream of data during our testing. Although the inherent lag time in satellite linkups made the connection too "laggy" to play something such as Age of Empires online, the throughput was more than adequate to watch streaming video, surf sites, and check email. During a typical transcontinental flight, passengers will experience a few blackouts as the plane moves out of range of one satellite and into that of another, but these periods last typically less than 10 minutes.

Schweiger says his team selected Linux to keep the servers lean. The intent is to run FlyNet without ground-based server support. Linux also allows for stripping out components not necessary for an in-flight application. Lufthansa also rejected closed-source solutions in other areas. An early meeting with one company looking to provide in-seat terminals was unsuccessful, as the team felt it was vital to give travelers access to their data their way. That's not to say passengers aboard will be surfing adult sites. Lufthansa hopes to keep porn at the newsstands; although it wouldn't comment on its exact system, it did provide assurances that Internet filtering will be provided.

Schweiger also expects the FlyNet service to operate without in-plane tech support. Flights during the three-month testing period included flight-crew-turned-support staff, but the cost of maintaining such a tech support crew is too high, especially when factored across 80 planes. With a browser-based login, though, it should be as easy to configure FlyNet as other terrestrial Wi-Fi offerings.

The Changing Tide

FlyNet, though, is especially impressive (and ambitious) when viewed in the context of the state of worldwide business Internet connectivity. Our recent trip to Germany revealed that, just as in U.S. hotels, coffee houses, transportation hubs, and some restaurants, Internet connectivity solutions ranged from free to very expensive across the ocean. The Steigenberger Hotel chain in Germany, for example, is pushing to wire its hotels with a number of solutions available at its various chains, while coffee shops stumble over each other to get connected.

Much of the domain of the business traveler is still Internet-free, though. Many airports lack broadband connections of any kind, and although some carriers are outfitting their lounges, the installation pace isn't nearly fast enough and is mostly found inside the carrier's branded (and expensive) lounges.

Lufthansa's Internet plane might be the turning of the tide, though. If business travelers get a taste of the always-on Internet connection, they might not be satisfied on an Internet-free trip again. More FlyNet planes mean more business travelers with notebooks. More travelers with notebooks mean more demand at hotels, and so on.

A number of U.S. carriers pulled out of the FlyNet project, citing declining revenues (due in part to Sept. 11 and the war with Iraq). As a result, it may be some time before air travel becomes entirely technologically friendly. The Internet is here to stay, however, and now that the technology has been shown to work, it may be only a matter of time until the clamor of the business traveler becomes loud enough that a carrier has to come around, if only out of fear of losing business to other airlines.

In the meantime, Lufthansa is changing the meaning of "in-flight entertainment" from merely showing B-level movies to offering an Internet-connected 747 in the sky. CPU

by David Schloss

Coder's Corner: XML

XSLT Part VI: Booleans & XPath

In Coder's Corner: XML, Ian Graham shows you how to program with XML. Ian is the author of such books as "The HTML Sourcebook" and "The XML Specification Guide."

Last month, we looked at some complex features of XSLT, namely <xsl:if> blocks; parameterized templates (where parameters passed to the template control template behavior), and variables (which are like more functions in XSLT). We demonstrated these features using transformations applied to an example document consisting of a data element containing a sequence of item elements, with each element containing information about famous physicists (see May's *CPU* for the examples).

In previous articles, we've shown how to convert each <item> element into an HTML table row and how to sort the order of the output alphabetically (by <name>) or numerically (by birth year from the <birthday> field). Last month, we extended the sorted output example to create two style sheets, with each adding one of the following behaviors:

- Omit from output any <item> with a birth year less than 1900
- Alternate the background colors (gray and white) of the output HTML rows

This month, we'll look at combining the behaviors, leading us to a more detailed understanding of some aspects of XPath expressions and hopefully to a better understanding of the XSLT processing model. We'll also look at more complex sorting mechanisms, or the style sheet's behavior when more than one <xsl:sort> element is attached to a given <xsl:for-each> loop.

Alternate Row Shading & Data Elimination

Our goal is to modify last month's style sheet to combine the features, thus eliminating from output persons with a birthday prior to 1900 and changing the output formatting so the generated HTML table rows alternate gray and white backgrounds.

An obvious (but incorrect) first attempt would be to combine the XSLT mechanisms we used last month. The result would be:

```
<xsl:template match=”/”>
.... omitted content ....
  <xsl:for-each select=”/data/item”>
    <xsl:sort select=”normalize-space(name)” />
     <xsl:if test=”substring(normalize-space
(birthday),string-length(normalize-space(birth-
day))-3,4) &gt;= 1900”>
        <xsl:apply-templates select=”.” >
           <xsl:with-param name=”rowCount”
select=”position()” />
        </xsl:apply-templates>
    </xsl:if>
  </xsl:for-each>
... omitted ...
</xsl:template>

<xsl:template match=”/data/item” >
  <xsl:param name=”rowCount” />
  <xsl:variable name=”rowBgColor” >
     <xsl:choose>
     <xsl:when test=”$rowCount mod 2 = 0”>
        <xsl:text>white</xsl:text>
     </xsl:when>
     <xsl:when test=”$rowCount mod 2 = 1” >
        <xsl:text>orange</xsl:text>
     </xsl:when>
     <xsl:otherwise>
<xsl:text></xsl:text></xsl:otherwise>
    </xsl:choose>
  </xsl:variable>
    <tr bgcolor=”{$rowBgColor}” >
     <td> <xsl:value-of select=”name” /> </td>
```

Coder's Corner

```
        <td> <xsl:value-of select=”birthday” /> </td>
        <td> <xsl:value-of select=”birthPlace” /> </td>
    </tr>
  </xsl:template>
  </xsl:stylesheet>
```

In the main template, the <xsl:for-each> element loops over all the <item> nodes—sorted alphabetically by name (<xsl:sort>)—while the <xsl:if> selects only those with dates greater than 1900. <item>s that pass this filter move to the row-generating template, which uses the passed parameter (rowCount, containing the value of the position() function) to choose the row's background color: gray (#cccccc) if odd, white if even.

This doesn't work because the position() function counts the position in the sequence of looped <item> elements, which isn't the same as the order of the item elements actually passed to the row-generating template. For example, if the first three <items> elements in the sorted <xsl:for-each> have dates of 1902, 1899, and 1903, only the first and third will pass on. However, these will have positions() of one and three, respectively, because these are their positions in the <xsl:for-each> loop. Thus, both have a gray background.

The Elegant (& Correct) Approach

The solution is to use an XPath expression on the <xsl:for-each> element that prefilters <item> elements, eliminating those with birth years less than 1900. The needed code in the main template is:

```
  <xsl:for-each select=”/data/item[substring(normalize-space(birthday),string-length(normalize-space(birthday))-3,4)
&gt;= 1900]” >
      <xsl:sort select=”normalize-space(name)” />
      <xsl:apply-templates select=”.” >
        <xsl:with-param name=”rowCount” select=”position()” />
      </xsl:apply-templates>
    </xsl:for-each>
```

In fact, this is simpler than the first (incorrect) attempt. The cleverness is in the select attribute value:

```
/data/item[substring(normalize-space(birthday),string-length(normalize-space(birthday))-3,4) &gt;= 1900]
```

This XPath expression selects for /data /item nodes but places a condition on the selected nodes. This condition (in the square brackets) is a Boolean expression that's true whenever the year (as extracted using the complicated string expression) is greater than 1900; it's false, otherwise. Thus, the selected node list contains only the <item> nodes satisfying the date condition. As a result, the <xsl:for-each> loops over precisely the nodes to be converted into HTML table rows. The <xsl:if> is no longer needed. Also, position() now accurately references the row into which the item will go. The evenness/oddness of $rowCount correctly controls the rows' color.

XPath Syntax Details

Formally in XPath, the stuff inside square brackets after a node-set expression is called a **predicate**. In XPath, predicates are Boolean properties that must be true for each node in the selected node list; they serve as a filter for restricting the items selected into the XPath node set. Thus an XPath expression, such as /data/item[expr], really implies the following behavior, "Start with the /data/item node list. Take each node and, for each, test to see if 'expr' evaluates is true. If so, keep that node. If not, (it evaluates to false, for example), drop it. The resulting node list is the collection of nodes for which 'expr' evaluates to true."

XPath defines several shorthand notations to make XPath expressions easier to write. An XPath expression, such as /data /item[2], that intuitively selects for the second node in the /data/item node list, is really shorthand for the more complicated (but equivalent) expression: /data/item [position()=2]. The latter more clearly illustrates the Boolean nature of the predicate (is position() equal to 2?).

Predicate filtering is a powerful tool in XPath; it lets you prefilter nodes before doing any work on them. Indeed, any time you want to construct a style sheet that selects a bunch of nodes, you can almost always construct an XPath expression that does the trick.

Multiple <xsl:sort>

To now, we've used a single <xsl:sort> element to define the order of the nodes inside an <xsl:for-each> (or an <xsl:apply-templates>). However, you can have multiple <xsl:sort> elements present, allowing for nested sorting of the nodes. This makes complex sorting of output very easy. To see how this works, consider changing the example stylesheet to:

```
  <xsl:for-each select=”..... omitted...” >
      <xsl:sort data-type=”number”
       select=”substring(normalize-space(birthday),string-length(normalize-space(birthday))-3,4)” />
      <xsl:sort select=” select=”normalize-space(name)” />
    ....
```

As described in the March 2003 *CPU*, the first <xsl:sort> sorts the nodes in increasing order of birth year. However, if multiple nodes have the same birth year, they stay in document order, or in the same order as in the source data, unless a second <xsl:sort> comes into play.

The second sort condition is applied *after* the first one. The first condition sorts the items by increasing year, and the second sorts items in increasing alphabetical order, but within the constraints of the first sort rule. Let's suppose the source data contains data with these birth years and names:

1921	Andrei Sakharov
1901	Werner Heisenberg
1901	Ernest O. Lawrence

Then the first <xsl:sort> reorders:

1901	Werner Heisenberg
1901	Ernest O. Lawrence
1921	Andrei Sakharov

The second would alphabetically reorder the last two (Ernest before Werner), yielding:

1901	Ernest O. Lawrence
1901	Werner Heisenberg
1921	Andrei Sakharov

CPU

by Ian Graham

(Full examples of this article's documents are available at www.utoronto.ca/ian/articles/jun03.)

Lisa Lopuck, www.lopuck.com, is a Web creative consultant helping companies define and plan their Web creative strategy, information flow, and visual look and feel. She is also the author of numerous best-selling books on Web design, including "Web Design for Dummies," and is a sought-after speaker at Web conferences and universities around the world.

by Lisa Lopuck

Flash Meets QuickTime

I recently came across a Web site that wasn't like any other site I've seen, and I was immediately inspired and intrigued. In this site, your standard, everyday browser window is completely irrelevant. The site breaks out and becomes its own free-floating, draggable, interactive experience that sits on top of everything else on your Desktop. If that's not enough, the site lives in an odd shape; it is not confined to the usual rectangular window shape.

To treat yourself to this uncommon Web site experience, make sure you have QuickTime 5 and the latest Flash plug-in installed and then go to www.movtv.com. Click the Go button in the lower-right corner, and on the subsequent page, click the big circular graphic. What happens next is a super-cool, out-of-the-browser experience.

How Does it Work?

The MOVTV Web page contains a standard <embed> tag that references a QuickTime movie. The page auto-launches the movie, which opens the QuickTime Player. (On slow connections, you'll see the standard QuickTime Player briefly—not cool.) Once the movie loads, its 1-bit mask takes over and accounts for the odd-shaped interface. Embedded in the QuickTime movie is an animated, interactive Flash movie.

> **The net result of the Flash/QuickTime combination is an odd-shaped, animated, interactive, draggable, float-on-top-of-everything-else Web site experience.**

The developers of MOVTV, Tubatomic Studio, used the new "Media Skins" functionality and advanced scripting capabilities of QuickTime 5 to make this new Web experience possible. The Flash component enables animation and interactivity—including the ability to interact with an underlying browser window. The net result of the Flash/QuickTime combination is an odd-shaped, animated, interactive, draggable, float-on-top-of-everything-else Web site experience. The one drawback to the Flash/QuickTime approach, however, is that the odd-shaped mask is 1-bit (no transparency), and you cannot animate it.

A similar, out-of-the-browser approach is used at www.liloandstitch.com. In this case, you can download an interactive character, Stitch, as a standalone application (Windows only) that lives on your computer independent of an Internet connection. Stitch runs around your screen (animated and masked) wreaking havoc—tearing through your screen, jumping up and down and shaking your interface. These cool effects could probably be done in a Web environment with JavaScript. Imagine a jet flying out of the Boeing Web site, and your browser shaking in the turbulence!

Real-World Applications

Where could you go with technologies like these? For starters, like MOVTV, you can create a fully self-contained Web site that leverages all of Flash's interactive and animation capabilities, yet has a completely new, browserless look and feel.

Alternatively, you could create interesting navigation or helper tools that live outside of the main browser-based Web site. For example, like Stitch, you could create an animated character that helps you through tasks on a site. Another idea is to build an alternative global navigation scheme such as a timeline or a map or to build a repository tool such as a scrapbook or a shopping cart.

I would stop short, however, of fully relying on this technology as your main means of navigating a Web site. Although these technologies require standard QuickTime and Flash plug-ins, they are the newer versions that not everyone may have. In addition, you could run into accessibility problems with Flash. (Flash MX has some new features for accessibility; check www.macromedia.com for details.)

More Information

If you are eager to dig in and start experimenting with creating your own browserless Web sites, the Apple Web site (www.apple.com) has a good tutorial on creating your own Media Skin for a QuickTime movie. For the Flash component, look into Macromedia tutorials on exporting Flash movies in the QuickTime MOV format. ■

You can contact Lisa at lopuck@cpumag.com

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by Rob "Cmdr Taco" Malda

ampthis.txt

Rob "CmdrTaco" Malda is the creator and director of the popular News for Nerds Web site Slashdot.org. He spends his time fiddling with electronic gizmos, wandering the 'Net, watching anime, and trying to think of clever lies to put in his bio so that he seems cooler than he actually is.

Digital technology has revolutionized many aspects of our lives. Music was one of the earliest mass consumer mediums to embrace digital technology, from the first music to be mastered digitally—I remember putting on a pair of headphones and listening to "Brothers in Arms" by Dire Straits, the first album I ever saw that proclaimed proudly on its cover that it was digitally recorded—to the mass acceptance of the compact disc as the format of choice for music distribution.

With the rise of digital technology came an army of audiophile purists with their viewpoint that analog records contained a more true and accurate recording of music. I'm not going to get into that argument here. I think that was a fair argument 15 years ago, but today the fight is over, and vinyl is now a niche market.

Now CDs can hold 600 megs of data. That's a lot of bits and bytes for your music. And a modern digital jukebox holds 20 gigs. That's enough for 20 CDs easily. Of course, nobody actually stores fully ripped CDs. We compress them. By throwing away a few bits here and there and compressing away the sounds that the human ear can't hear so well, we can cram hundreds of CDs where before we could have only stored dozens.

> **If you spend your days with headphones glued to your head, you owe it to yourself to get one of these things.**

And now the digital vs. vinyl debate rears its ugly head once again because now the digital version really does sound terrible. Which leads me to a couple easy solutions you can use to try to keep your MP3 collections from sounding utterly awful.

The first is the easiest and cheapest. Rip all of your CDs at a higher bit rate. I've found that at 192Kbs, the quality of the sounds starts being relatively indistinguishable unless you're listening to your music on a better stereo system. Of course, the trade-off here is obvious: Those precious gigabytes on your mobile MP3 player will become all the more crowded because each track will be anywhere from a third to a half-size bigger. But things sound much better.

But never fear: There are other options that are more expensive! Recently I've been testing something called the HeadRoom AirHead. It is available at www.headphone.com and runs from $120 for the smallest portable units on up to more than your MP3 player. But these small wonders will make your precious iPod or Archos sound so much better it will blow your mind. You won't be fooled into thinking you're listening to the original CD, but it sure will push it out of your mind.

It seems obvious, really: Those giant speakers in your home stereo take a lot of juice to run. Those headphones are just really tiny speakers drawing power from your portable MP3 player. Now how much power do you think that little device has to spare? Well, listening to your tunes for a few hours through the AirHead will show you. Suddenly the bass in your music will have that thump you've been missing. And treble? Remember treble?

The only question you'll have when you take off the headphones is why this glorious device isn't built in to your MP3 player already. The AirHead is about the size of a pack of cigarettes, which means it nearly doubles the space required for your average portable music collection. But most of that space is batteries. You can purchase special bags that are even designed to mate your iPod and your AirHead together, but half the joy of the iPod is the amazingly tiny form factor. Carrying the amp with it really negates the whole size argument.

For home use, you can even plug the amp in and use it all the time without fear of needing new batteries. If you spend your days with headphones glued to your head, plugged directly into some crappy sound card, you really owe it to yourself to get one of these things. It's tiny and simple, and it really puts the punch back into your music. ■

Jam with Rob at malda@cpumag.com.

by Joan Wood

Embedded Bloggers

Starting as gopher for the Emmy-winning team that pioneered live in-car TV cameras for the Indy 500, Joan became an independent video/sound engineer, technical director, and producer. Playing with Reality Engines and motion platforms led to co-founding Xatrix Entertainment, where she produced the two Cyberia games. Before 3D acceleration was trendy, she formed Mango Grits to develop hardware-only game Barrage for Activision. Since cashing out from SharkyExtreme.com, where she was co-founder and managing editor, Joan has retired.

A typewritten quotation on a yellowing 3- x 5-inch index card, now framed, has occupied a place on my desk since I was a bright-eyed newbie in TV production. It is from Edward R. Murrow, one of a group of radio journalists who became a household name by broadcasting from WWII London during the blitz. You could call him an early adopter, as he grasped right away the enormous impact that the medium of radio could bring to war reporting. He even pioneered "embedding" by riding along on bombing runs over Berlin and giving his report the next day. It got him into trouble with his network, but the "Orchestrated Hell" broadcast that came out of it painted his vision of war for the folks back home.

After the war, Murrow migrated over to TV, which was rapidly replacing radio as the in-home entertainment appliance, pumping out 1950s conformity along with ads for Winston cigarettes and Wrigley's chewing gum. He took on the challenge of covering some of the big issues of the day—McCarthyism, the Middle East, the tobacco industry—which won him awards and got him into trouble with his network again. Murrow disagreed with the idea that news should be sanitized and that the public was incapable of handling unpleasant subjects. He was alarmed at the role commercial sponsors played in propagating uncontroversial content and how much broadcast news had become commercialized. He said:

> "This instrument can teach, it can illuminate; yes, and it can even inspire. But it can do so only to the extent that humans are determined to use it to those ends. Otherwise it is merely wires and lights in a box. There is a great and perhaps decisive battle to be fought against ignorance, intolerance and indifference. This weapon of television could be useful."

Lately I've been sleeping with the television on. . . .

What would Murrow think of our round-the-clock, multiple-channel cable, broadcast, and online war news? Surely the scope and variety of coverage is unprecedented. Hundreds of embedded and free-floating journalists with digital cameras, satellite phones, gas masks, and email, each witnessing and reporting a piece of the whole story, filtered to some degree through personal bias, political leanings, cultural background, and not enough sleep.

A few reporters did start war blogs, but that got them in trouble with their networks. Major news organizations such as CNN are prohibiting reporters from blogging (see www.kevinsites.net), but that is likely to change over time. An embedded reporter's blog could add the depth currently missing from the snippets and sound bites. Searchable, collective blog-style reporting may become a very natural way to represent events that unfold over weeks and months and have many disparate witnesses, and Internet-ready mobile phones with onboard audio recording and digital imaging will eventually evolve into multimedia transmitters, including lip-reading speech recognition text for automated multimedia blog publishing. In my dreams, anyway. But lately, I've been sleeping with the television on. . . .

It was about TV that Edward R. Murrow made the observation in my framed quotation. "The trouble with television," he said, "is that it is a sword, rusting in the scabbard, during the battle for survival."

It is not a defeatist comment; it is a challenge: to find ways to make the medium work better, to communicate better. The battle for survival is always present, always changing. A few years ago, I opened up the frame and drew a line through the word "television." I replaced it with the word "Internet" and put it back in the frame. It is right here, on my desk. ■

Send puzzle pieces to joan@cpumag.com.

Read Murrow's full speech to the Radio-Television News Directors Association, October 15, 1958: www.rtnda.org/resources/speeches/murrow.shtml.

by Chad Denton

Road Warrior

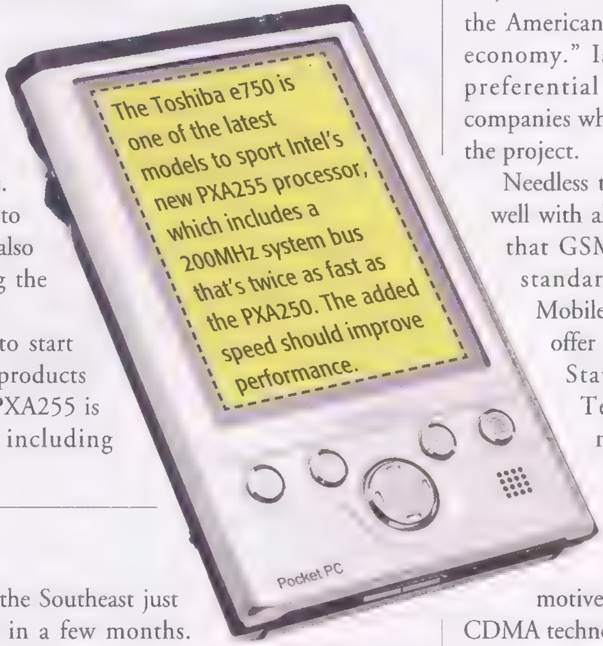
Processors, Pork Barrels, BlackBerry On Pocket PC & More From The Mobile Front

Intel's Other New Mobile Processors

In March, Intel announced plans for two new PDA processors, the PXA260 and PXA263, both available at 200MHz, 300MHz, and 400MHz. Both processors are pin-compatible with the PXA261 and PXA262 processors. Although the PXA260 won't provide any extra performance, it is more than 50% smaller (0.51 inches x 0.51 inches x 0.069 inches) than previous standalone processors. The PXA263 includes 32MB of Intel's StrataFlash memory stacked on top of the processor. Stacking is designed to conserve space and let manufacturers create smaller devices or implement more features without increasing size.

Intel also announced the availability of its PXA255, which is pin-compatible with the popular PXA250, so manufacturers can simply drop the new chip into existing designs. The PXA255 features a 200MHz system bus to help improve overall performance. Intel has also improved the power consumption, dropping the voltage from 1.5 volts to 1.3 volts at 400MHz.

The PXA260 and PXA263 are expected to start shipping in volume in Q2 this year, with products featuring the new processor to follow. The PXA255 is already implemented in some products, including Acer's n10 PDA.


The Toshiba e750 is one of the latest models to sport Intel's new PXA255 processor, which includes a 200MHz system bus that's twice as fast as the PXA250. The added speed should improve performance.

Swapping Spectrum

Some 141,000 U.S. Cellular customers in the Southeast just might become AT&T Wireless subscribers in a few months. AT&T Wireless (www.attwireless.com) struck a deal with U.S. Cellular (www.uscc.com) for 25MHz licenses in Georgia and parts of northern Florida. In exchange, U.S. Cellular will get 10MHz and 20MHz licenses in 13 states and $31 million in cash. Because AT&T Wireless isn't currently using the spectrum, U.S. Cellular will not automatically acquire any new customers, just the right to build out networks in new markets in the Midwest and Northeast.

Pork-Barrel Politics & A Wireless Iraq

In March, U.S. Congressman Darrell Issa, R-Calif., introduced H.R. 1441, which would "mandate the use of U.S. based CDMA cell phone technology" in building Iraq's wireless infrastructure after the war, according to a press release on Issa's Web site (www.issa.house.gov). The release referred to GSM as "European-based," and Issa is quoted as saying, "If U.S. taxpayers are going to be gifting billions of dollars in technology and infrastructure to the Iraqi people, we ought to make sure, to the greatest extent possible, that those expenditures also benefit the American people and the American economy." Issa's bill would also give preferential treatment to American companies when it comes time to bid on the project.

Needless to say, none of this sits too well with allies overseas who point out that GSM is far from a European standard. AT&T Wireless, T-Mobile, and Cingular Wireless all offer GSM service in the United States. American company Telephone Systems International did build the Afghanistan GSM network launched April 6, 2002.

You don't have to dig far to find possible motives for Issa's preference to use CDMA technology. Issa's district includes San Diego, home base of QUALCOMM, creators of CDMA technology. In fact, QUALCOMM was among the top 10 contributors to Issa's last campaign, according to Opensecrets.org (www.opensecrets.org).

AT&T Wireless & DoCoMo Scale Back U.S. 3G

NTT DoCoMo and its domestic partner in the United States, AT&T Wireless, have scaled back plans to implement 3G wireless networking. The original plan called for the introduction of WCDMA (Wideband Code Division Multiple Access) in 13 of the 50 largest U.S. markets. The less ambitious revision calls for a rollout in just four markets: Seattle, San Francisco, San Diego, and Dallas.

If AT&T Wireless fails to launch WCDMA services in the four markets, it could cost AT&T $3.65 million. According to agreements between NTT DoCoMo, AT&T Wireless, and AT&T, NTT DoCoMo would have the right to sell its shares in AT&T Wireless back to the company at $9.8 billion plus interest. If AT&T Wireless can't pony up the cash, AT&T could be forced to pay NTT DoCoMo $3.65 million. Ouch.

Wireless World

According to Gartner Dataquest, worldwide sales of mobile phones rose 6% in 2002 to more than 423 million units. A Q4 buying spree, representing a 14% increase over Q4 sales the previous year, was a major reason for the better-than-expected annual numbers, according to Gartner Dataquest.

2002 was a good year for most handset leaders. Nokia stayed on top with a 35.8% market share, up about 1% overall from 2001. Nokia's 8.4% growth in 2002, however, was a bit lower than some of its competitors. Motorola was a distant No. 2 with 15.3% market share in 2002, up from14.8% in 2001. Samsung was No. 3 with a 9.8% share. Samsung, however, saw one of the highest growth rates in 2002, with sales nearly doubling. Siemens posted an 8.2% market share, while Sony Ericsson sold fewer handsets this year than Ericsson did by itself last year.

Nokia managed to stay on top of the global handset market thanks in part to phones such as the Nokia 3650, which includes a built-in camera for taking pictures and recording short video clips.

Palm's Not Having A Good Year

Palm (www.palm.com) had a disappointing Q3. Revenue was down 28.6% to $209 million from $292.7 million a year ago. Add in larger-than-expected expenses, and Palm's Q3 net loss is $26.5 million if you exclude additional expenses for amortization, separation costs, impairment charges, and restructuring charges. Using GAAP (Generally Accepted Accounting Principles), which include such expenses, Palm showed a net loss of $172.3 million, or $5.93 a share. These numbers include Palm and its software subsidiary PalmSource. Palm had plans to spin PalmSource off by midyear, but it has since delayed the plans until sometime this summer.

Palm OS 5.0 and the Palm Tungsten T did little to help Palm in the third quarter. The company lost a combined $26.5 million, which doesn't even account for various other expenses.

If AMD Made An Announcement In A Centrino Forest, Would Anyone Notice?

In an attempt to steal the proverbial thunder from its competitor, Intel released its Centrino-branded technology to consumers March 12. The media largely ignored the Centrino hype, however, and focused instead on AMD's impressive announcement of 12 new mobile processors.

At least that's how Geraldo Rivera or Peter Arnett might have reported it. Actually, Intel grabbed the spotlight with its March 12 Centrino release and few people even noticed AMD (www.amd.com) shouting, "Look at me." So, in case you missed it, AMD did announce 12 new mobile processors it will brand as Athlon XP-M. Yes, that's right, XP-M. No one plays off other product names quite as well as AMD.

With its low-voltage processors (model numbers ranging from 1400+ to 1800+), AMD is hoping to break into the thin-and-light notebook segment. This popular segment could help AMD gain a much better foothold in the notebook market.

Higher-end processors' model numbers will range from 2000+ to 2600+. The 2200+, 2400+, and 2500+ processors will be based on the Barton core. Barton doubles the L2 cache from 256KB to 512KB, for 640KB of L1 and L2 cache. Notebooks with the processors will be available from Fujitsu, Sharp, NEC, Sony, and HP.

RIM Signs Big Names

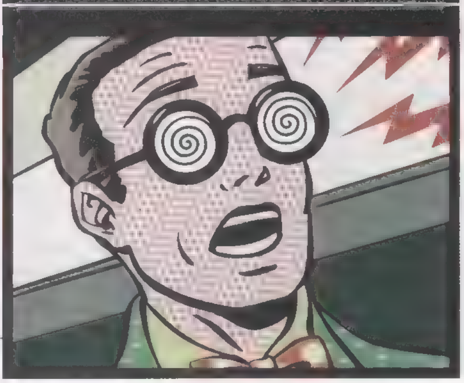
It's nice to see RIM in the news for something not involving a judge and intellectual property lawyers. At CTIA Wireless in March, RIM announced that it was taking on licensees, including those from Microsoft and Symbian. The Microsoft deal covers Pocket PC and Smartphone 2003 platforms. The Symbian deal will bring BlackBerry to smartphones running Symbian's OS. RIM is also expected to sign Nokia, in 2003's second half.

BlackBerry is extremely popular among mobile professionals because the device lets them stay in the email loop when they are away from the office. Although RIM's own BlackBerry devices do offer some PIM features, we are excited to see the service offered on real PDAs and smartphones.

In addition to the licensees, RIM announced the introduction of its new BlackBerry 6210. The device includes voice and SMS messaging, in addition to email.

At Your Leisure

Compiled by Samit G. Choudhuri & Chris Trumble

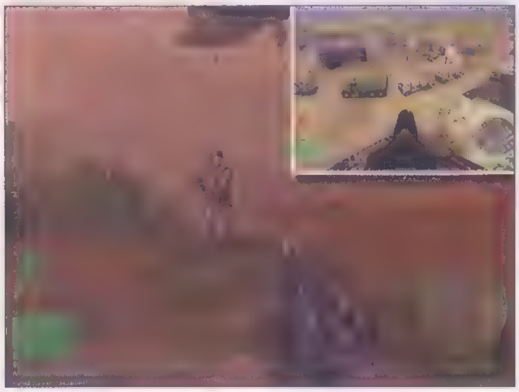


Plug In, Sit Back & Fire Away

The entertainment world, at least where it pertains to technology, morphs, twists, turns, and fires so fast it's hard to keep up. But that's exactly why we love it. For the lowdown on the latest in PC entertainment, DVDs, consoles, and just stuff we love, read on.

Delta Force: Black Hawk Down
Time To Experience Some Shock & Awe

When you hear the words "Black Hawk Down," you may think of the excellent Ridley Scott film (based on Mark Bowden's book) of the same name (of which there's a special edition DVD due later this summer). There's no extra special edition footage in the game (a la Enter The Matrix) or any affiliation with the movie or book. Also the "Delta Force" portion of the name shares nearly nothing with the preceding Delta Force games (by Novalogic) except the name, which is a good thing. That said, we really weren't sure what to expect from this game; we ended up being pleasantly surprised, even though the timing of the release seems somewhat in poor taste.

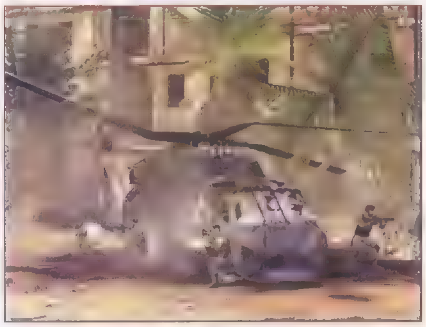


Black Hawk Down features plenty of variety in missions, and the gameplay deftly blends action and strategy.

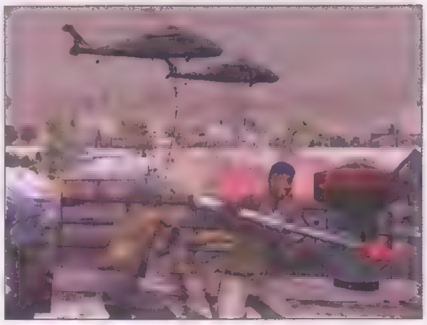
The game is beautifully rendered with Novalogic's Comanche 4 game engine. What was once intended for a chopper sim carries over surprisingly well in the FPS realm. The in-game textures, color palettes, and objects are very attractive. Mogadishu never looked this good. However, even more impressive is the fact the game runs very well at high resolutions, and with some high-end options enabled (yes, even on a crappy old 1.8GHz P4 with a NVIDIA Ti4600).

You start the game in the 10th Mountain Division, but you will also have the opportunity to later play as a Ranger and a Delta Force operative. The variety found in the 20 missions (leading up to the scenario depicted in the book) will keep you very entertained. The game balances the action and strategy aspects of the missions incredibly well, and you'll discover some very big maps (especially in the final mission).

The game's enemy and friendly AI could be improved (your squad members sometimes seem like decoration), and there are not enough Somalis running around (obviously a performance-related issue). However, these minor problems were not enough to keep us from sticking with the game. It's been several months since we've seen a FPS in the vein of EA's Medal Of Honor: Allied Assault, and Delta Force: Black Hawk Down falls squarely in that category. It makes for great entertainment.



This is a very good game, but it doesn't depict the reality and suffering of the real deal.



It won't take long for you to discover that the "Mogs" don't take kindly to visitors.

Delta Force: Black Hawk Down (PC)

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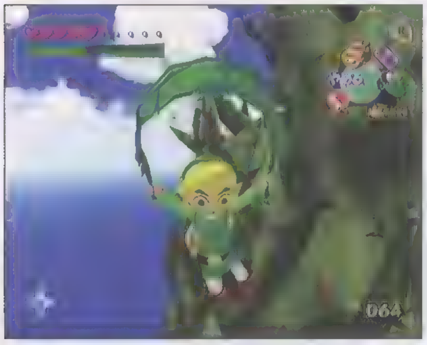
The Legend of Zelda: The Wind Waker
Nintendo Does It Again

Pundits have occasionally taken Nintendo to task for relying too heavily on its big franchises, such as Super Mario, The Legend of Zelda, Metroid, etc. But if you're a longtime Zelda fan, spending a few minutes with The Wind Waker will very quickly make you glad the company isn't afraid to stick with what works.


Link finds a few new ways to get around in The Wind Waker, including hang-gliding with a giant deku leaf.

The first Zelda game on the GameCube, TWW is a rollicking adventure that incorporates just the right blend of old and new. Most of the best elements of Link's past adventures are present, and of course the music draws heavily on themes so familiar they instantly take you back. The game's cel-shaded graphics (you know, the ones that had purists in an uproar a year ago when they were announced) give the game a slightly different feel, but their rich, vibrant colors do a remarkable job of bringing Link's world to life.

In this installment, we learn an interesting thing about Link himself. Namely, that there isn't a single Link at all; instead, heroes named Link have arisen from multiple generations to protect the world from the threat of evil. The current Link is growing up on Outset Island when a giant bird snatches his little sister and carries her off to a fortress across the sea. (By the way, everything's across the sea in TWW. The game's world consists entirely of a huge ocean peppered with numerous islands to explore.) Link sets off to get her back, and along the way he gets caught up in the classic struggle between good and evil.

In the course of the game, you'll meet all sorts of interesting characters, fight a variety of nasty critters, and claim a bevy of powerful objects that will help you advance. The most crucial gadget is the Wind Waker, a magic wand that lets Link call on the forces of nature and magic to do all sorts of cool things, including changing the direction of the wind, turning night into day and vice versa, and more. Essentially, the Wind Waker replaces the Ocarina of Time from Link's N64 adventures, but includes more standard options.

As was the case with all previous Zelda titles, the best thing about this game is exploring a fantasy world and figuring out how to get where you need to go. Sure, the combat is engaging and other gameplay elements are very well done, but guiding Link through traps, pitfalls, and puzzles to obtain a magic artifact that opens up new areas is absolutely intoxicating. It's surprisingly easy to sit down and shred three or four hours at a time playing this game and not even notice it because the hook of seeing the next dungeon or completing the next miniquest is hard to resist.

We love the new look, we love the controls (the GameCube's controller is vastly superior to the N64's for games like this), and as previously mentioned, the music is nostalgically impeccable. We would have appreciated the ability to skip through some of the game's numerous repetitive cut scenes (opening treasure chests, using the grappling hook, the wind effect when you use the Wind Waker, etc.), as they seem like a way to artificially stretch the game, but this is the only obvious flaw. Along with Super Mario Sunshine and Metroid Prime, The Wind Waker completes a Nintendo trifecta of must-have GameCube games.

The Legend of Zelda: The Wind Waker (NGC)

$49.99 • Nintendo
www.zelda.com

DVD Byte by Todd Doogan

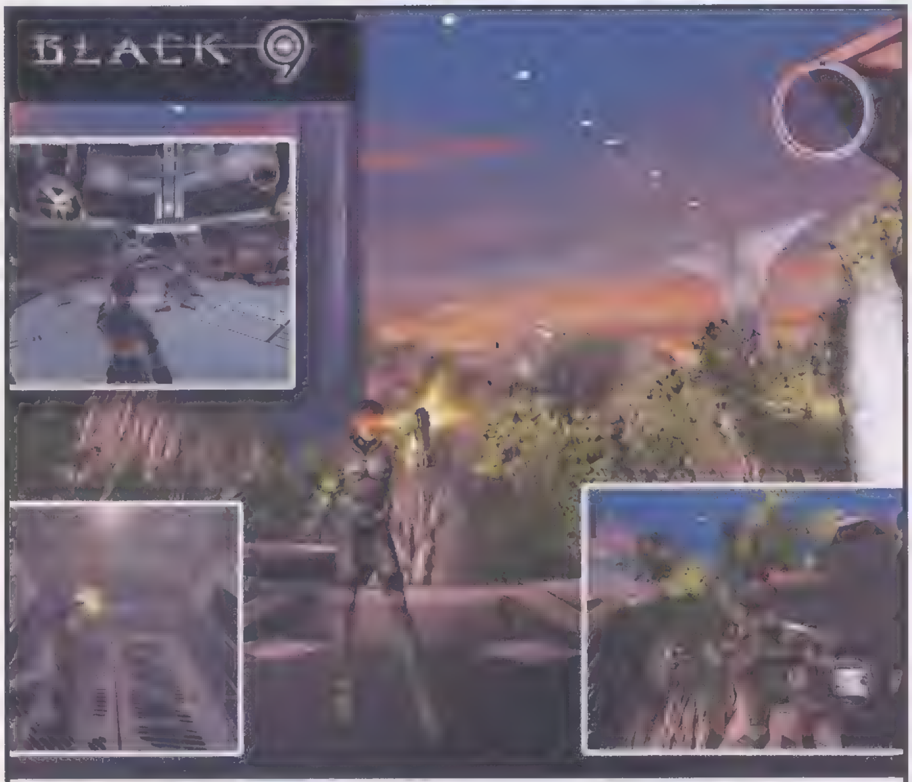
"In the beginning, there was Man. Then Man made the Machine in his own likeness; thus did Man become the architect of his own demise."

From the creators of "The Matrix" trilogy comes a beautiful look at the world and mythology surrounding these groundbreaking films. A few years back, the Wachowski Brothers approached some of the greatest cutting-edge anime filmmakers and asked them to head up a group of nine short films that would explore the world the brothers created. Earlier this year, online fans got to see, one by one, some of those films, and they absolutely knocked everyone's socks off.

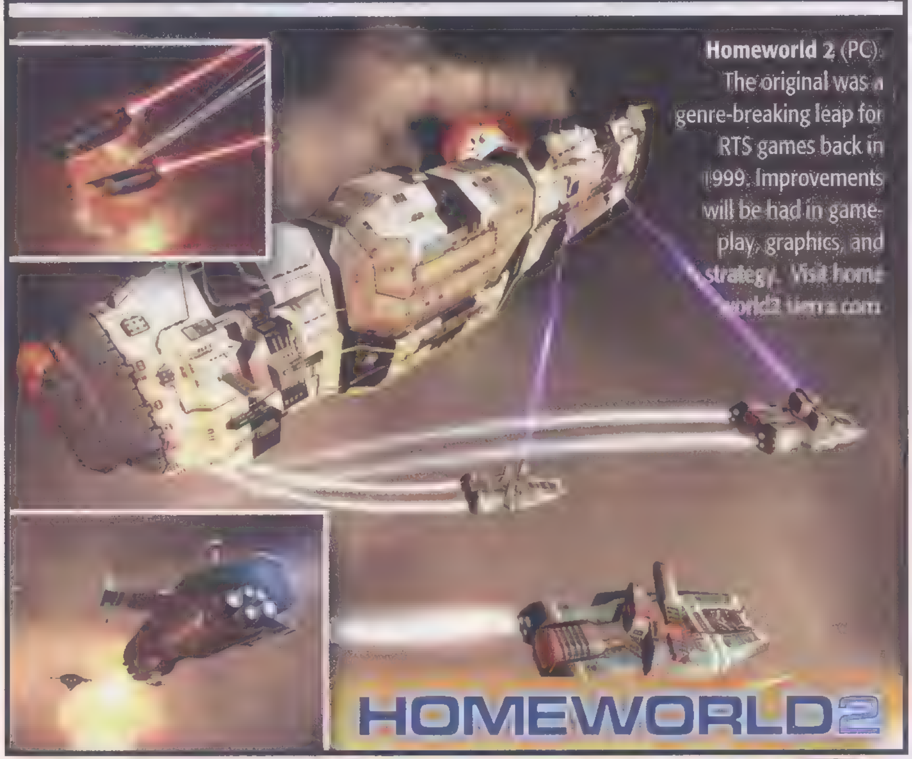
Now we'll get to see each of these shorts on DVD where they belong, and it's a hot little disc—a real beaut. Not only do we get the fabulous shorts in pristine anamorphic widescreen and Dolby Digital 5.1, but we also get four commentary tracks and director profiles exploring the works of these incredible artists. The biggest and best thing on this disc is a documentary chronicling the world of anime from its humble beginnings to its ever-growing present. There are also interviews with production members and a trailer for the Enter The Matrix platform game, which should be out as you read this. All in all, this is a great DVD to help fill the time while we wait until November for the final installment of this jaw-breaking series of films. △

Hot Shots: The Beauty Of The Game

Yeah, we know it's all about the gameplay. Sure, there are those who would have you believe graphics are relatively unimportant in the greater scope of things, but if you read *CPU* mag, you probably already know those folks are off their collective rockers. We want great gameplay combined with stunning graphics, and here are two upcoming games that show promise. Watch for them.



Black 9 (PC/Xbox). Black9 is not what it seems to be. You would be forgiven for thinking of it as your common shooter at first glance. But there's more to it than meets the eye. The game is action-heavy, but features a strong RPG backbone running through it. We'll know more when the game is released in the fall. You can visit www.black-9.com for more details.

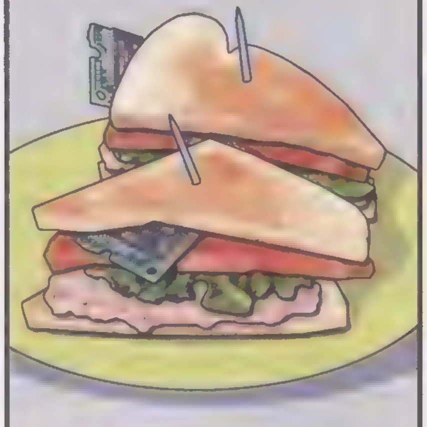


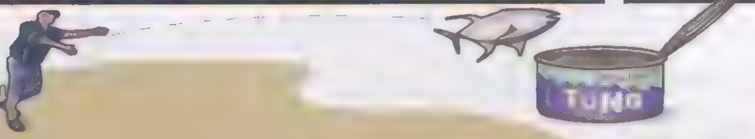
Homeworld 2 (PC). The original was a genre-breaking leap for RTS games back in 1999. Improvements will be had in gameplay, graphics, and strategy. Visit homeworld2.sierra.com

Infinite Loop

One Computer Salad Sandwich, Please

The next time you wrap your gums around a tuna fish sandwich, be careful you don't swallow any microchips. Marine biologists with the IATTC (Inter-American Tropical Tuna Commission, www.iattc.org/HomeENG.htm) have inserted tiny $1,500 computers into 17 yellowfin tuna near Panama to track temperature, growth, and behavior changes in the fish. Each computer has 16MB of RAM to hold about five years' worth of information and a fiber-optic wand for tracking.





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SOFTWARE TIPS & TRICKS

Optimize Outlook

THE THING ABOUT EMAIL IS THAT IT'S SO HIGHLY PERSONAL, AND IT IS SUCH A FREQUENT PART OF OUR DAILY ROUTINE, THAT WE WISH WE COULD streamline and personalize our email clients so that they work more like the way we think. We invoke our email client so often that we come to know and resent every extra mouse click it forces on us. Until we get an email program that can conform neatly and easily to the many individual ways in which users handle the daily flow of messages, we have to do our best to tweak what technology hath given us. In this case, we take on the most popular client of all, Microsoft's Outlook, and ferret out some ways to make it a bit more seamless.

Manage Multiple Sigs

If you are like me, you wear many hats and perhaps don many titles. Most Outlook users have a default signature that the program inserts into new email messages, which is handy in most cases. But what if you have an alternate signature that you use only occasionally? In this case, most of us have to delete the default sig from the new email and then navigate the Outlook menu structure to insert the alternate. Here is a cooler way.

First, configure Outlook to use Word to edit email by choosing Options from the Tools menu, clicking the Mail Format tab, and checking the Use Microsoft Word To Edit Email Messages checkbox. In the same dialog box, click the Signatures button (Signature Picker in Outlook 2000) to make as many sigs as you like. When you are finished creating signatures in the Create Signature dialog box, click OK and use the drop-down menus in the Signature area of the Mail Format tab in the Options dialog box to assign which signature appears by default when you create a new message or reply to a message. Close the Options dialog box and create a new email message. As long as Word is your email editor, all you need to do is right-click the default sig to get a pop-up menu that includes all of the alternate sigs you have created in Outlook. When working in Outlook, WordMail will replace the default sig with the new one without any copying and pasting.

Browse In Outlook

If you do a lot of your work in Outlook, you may not want to bother opening your browser just to check the latest news. To get around this, you can add folders that contain specific Web pages to your Outlook Folder List. Use the View menu to toggle on the Folder List. Right-click anywhere in the Folder List and choose New Folder to open the Create New Folder dialog box. Give the new folder an appropriate name and indicate where in the Folder List tree structure you want the folder located. Click OK.

Now, right-click the new folder and choose Properties from the pop-up menu. In the folder's Properties dialog box, click the Home Page tab and type the URL of the site you want to pop up automatically when you click the folder. In Outlook 2002, click the Show Home Page By Default For This Folder checkbox and then click OK. (In Outlook 2000, you will need to toggle on the Show Folder Home Page command in the View menu when you first click this new folder.) Now whenever you click that folder, the home page you specified will open in Outlook. You can also drag the folder item onto your Outlook Shortcuts list so that you can access the site anytime without having your Folder List open.

Task-Specific Shortcuts

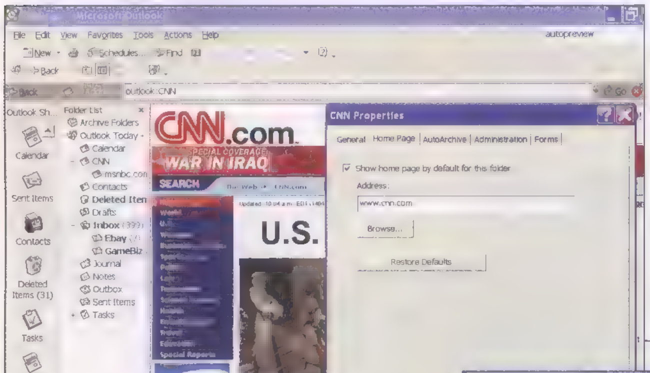
Is it really necessary to load Outlook and click the New Mail Message or Calendar icon every time you need to send a quick email or jot down that appointment with the person who just called? One of our favorite Outlook speed-up routines uses Outlook.exe's many command line switches to make task-specific shortcuts for the Desktop.

For instance, to make a shortcut icon that creates a new appointment in Outlook, right-click an open area of your Desktop and choose New,

Registry Tweak

The Run dialog box (Start, Run) has its own handy drop-down menu of previously used commands, but this little convenience soon becomes cluttered with old listings, perhaps some of which you don't want others to see or use. To clear this menu, go to HKEY_CURRENT_USER\SOFTWARE\MICROSOFT\WINDOWS\CURRENTVERSION\EXPLORER\RUNMRU to find alphabetized Value Names, each with a Value Name corresponding to one of the drop-down menu items. Simply right-click the Value you want to eliminate and choose Delete. The alphabetical list will re-sort itself. You need to reboot to see the effect. ▲

Shortcut. In the Create Shortcut dialog box, click the Browse button and locate your Outlook.exe file. In most default configurations, you will find the program on the drive to which Windows is installed and in the PROGRAM FILES \MICROSOFT OFFICE\OFFICE10 folder. Double-click Outlook.exe to pull the path name into the text box. Now, add a space at the end of the path name and type **/c ipm.appointment**. Note that if Windows puts quotation marks around the target path name, type the additional text *outside* of the quotation marks, not *inside* them. Click Next, name your new shortcut, and click Finish. Double-clicking the new shortcut icon on your Desktop will call up an Outlook appointment dialog box. The default day for the appointment will be the current day, but you can use the drop-down menus to change the time and date to your liking.



☑ Show home page by default for this folder

Address: www.cnn.com

You can assign any new folder in Outlook a URL so that by simply clicking the folder, a specific Web page in Outlook pops up, and you don't even have to open your browser.

To create a shortcut that opens a new email message, use the same shortcut procedure as above, but type **/c ipm.note** after the pathname. You can also use this new email icon to create a message with an attachment. Simply drag the file onto the shortcut to open a new message with the file attached. To create a shortcut that makes a new contact, type **c/ ipm.contact** after the path name. And to create a shortcut that makes a new task, type **c/ ipm.task** after the path name.

In WinXP, you can also simply drag the shortcut icon onto your Quick Launch toolbar on the Windows Taskbar to have it available anytime. And keep in mind that you can assign keyboard combinations to any of these shortcuts, as well. Right-click the shortcut icon, choose Properties, and click the Shortcut tab. Click in the Shortcut Key text box, ignoring the "none" entry. When you type in a combination such as CTRL-ALT-*letter* key, it will replace the "none" entry.

WinXP Tip Of The Month

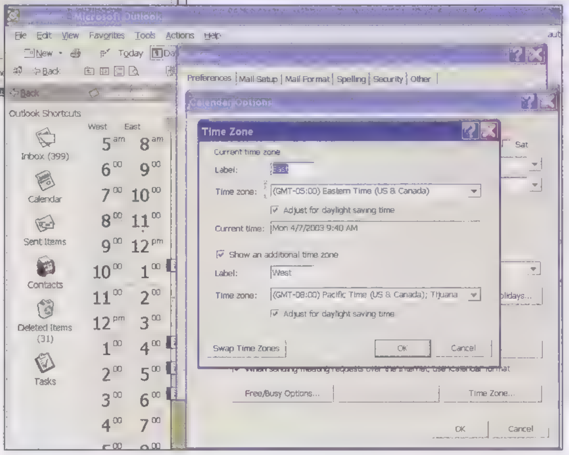
Tired of typing **www** and **.com** in Internet Explorer for every new URL you want to visit? Sorry to be the one to break this to you, fellow wirehead, but it turns out that you never had to do all that tortured typing in the first place. Simply type the name of your target dot com without the "www" and the ".com" and use the CTRL-ENTER key combo. When you do this, IE automatically adds "http://www" and ".com" in their proper places in the address bar. We tested this on systems with IE ver. 5.5 and later, but it may work on earlier browser versions, as well. Go ahead; type **cpumag** and press CTRL-ENTER, and we'll have you right where we want you. ▲

Time Zone Trouble

If you talk or travel across two time zones, you probably screw up appointments regularly when you or your contact miscalculate time zone differences. But you can avoid these time mixups by adding a second time zone to the Outlook Calendar so both time zones sit side by side.

Choose Options from the Tools menu and click Calendar Options. In the Calendar Options dialog box, click the Time Zone button. Because you are going to have two time zones showing at once, it is important to label each column, so give your current time zone a label, such as Central. Then check the Show An Additional Time Zone checkbox and give this second zone its own label. Use the drop-down menu to choose which alternate time zone you want to add. It is safest also to have the computer adjust for daylight savings time in both zones. Click all of the OKs necessary to confirm the choices and close these dialog boxes; now the alternate time zone should appear to the left of your current time zone.

If you are traveling into that alternate time zone with Outlook in tow, you can also use the same time zone screen to swap the alternate zone in as your default timekeeper.



Current time zone

Label: East

Time zone: (GMT-05:00) Eastern Time (US & Canada)

☑ Adjust for daylight saving time

Current time: Mon 4/7/2003 9:40 AM

☑ Show an additional time zone

Label: West

Time zone: (GMT-08:00) Pacific Time (US & Canada); Tijuana

☑ Adjust for daylight saving time

Outlook can help you juggle time zones by letting you list two zones in your daily calendar schedule and even swap them quickly when you are traveling between spots.

by Steve Smith

WARM UP TO PENGUINS

Create & Edit Images With The GIMP, Part II

LAST MONTH, WE BEGAN A TWO-PART PROJECT OF CREATING A MULTILAYERED IMAGE USING THE GIMP (GNU IMAGE MANIPULATION PROGRAM; www.gimp.org), with the goal of gaining a better understanding of The GIMP's abilities by using its various features. This month, we will add more layers of content to the image we started last month and apply some of the effects available in The GIMP. (Subscribers can read last month's article by going to www.cpumag.com.)

Add More Layers

With the project image we saved from last month open, look to the main GIMP menu and click the brush that's located to the right of the pencil. We are going to add another object to our image, so choose a spot in the image that isn't directly on top of the first object and click. A new copy of the object should appear. You will notice that using the pencil creates a 2D object (where the sphere actually looks like a big dot), while using the paintbrush will create a 3D object (where the dot has shading that gives it the appearance of looking spherical).

To see what happens using a different tool, click the pen (it resembles a calligraphy pen) that's beneath the pencil icon, and click a blank spot on your background. This produces a little dot. If you chose a different tip in the Brush Selection dialog box, it won't matter; the ink pen always produces the same tip shape.

Save the image by clicking the title bar to select it and press CTRL-S. Notice that now that we have added layers, we learn that TIFF can't actually store layers in its final format. So, we can export the image as a single piece or ignore the problem. Either way, the image we are working on now will retain the images in the layers, but once you close and reopen the image, you will find it's been flattened into a single layer. If you want to save this in a commonly used format, click Export to flatten the image and save it as a TIFF. Otherwise, select the image type XCF (GIMP), which is the native GIMP file format, and you can store this image with its layers still intact.

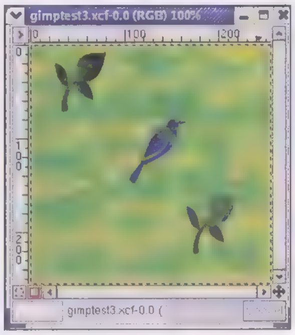


Figure 1: This four-layer image consists of a background layer, a layer containing an image of a bird, a layer containing flowers, and a layer containing an odd pattern applied on top.

Now let's add another layer. Return to the Layers dialog box and click the New Layer button. Name the new layer Layer 2 and click OK to close the dialog box. Here, we are going to experiment with freeform drawing, so return to the Brush Selection dialog box and choose one of the small circles, which represents the width of your pencil/pen tip. Again, you'll notice that this change is reflected in the main GIMP dialog box.

Now return to the color selector and choose a new color that contrasts with the previous colors we have picked. Again, the change is there to see in the main GIMP dialog box. Select the pencil icon in the main dialog box and experiment with drawing in your image. Feel free to cross over any of the objects you placed earlier, change pencil tips in the Brush Selection dialog box, and press CTRL-Z to remove something you just added if you don't like it.

When you're done experimenting with the pencil, select the brush to its right in the main dialog box. You might find it easier to keep track of what is what if you choose a new color for each of the implements. Select a new color here if you want, and experiment with the brush, brush tips, and more. You'll notice that the tips that look fuzzy or faded will produce a different effect than the solid ones. Finally, try the pen using different tips and colors.

Now we will look at what the layers are actually doing. In the Layers dialog box, click one of the icons that resemble an eye to remove a layer. Notice that the layer vanishes from the image and won't return until you click the eye to restore it. This feature lets you isolate layers in order to work on them individually.

If you are working in layers and want to merge a collection of them in a single image, a handy trick is to first adjust the eyes next to each layer so only the layers you want to merge are selected. Then go to the pop-up menu and select Layers and Merge Visible Layers. If your layers are getting unwieldy, this is the way you want to go.

The Effect Of Effects

Now that we have plenty of visuals to work with, it is time to really mess them up. First, we'll select a layer with a distinct image (you can pick anything but the background, really) by removing all of the layers on top of it so you can see what you are doing (you can remove them all if you want to make sure you can tell what is in this layer). See Figure 1 in this article to view the image we are applying effects to. See Figure 2 for the layer that we have chosen to work with (we have left the background in place), which contains a single graphic.

In the Layers, Channels & Paths dialog box, make sure you select and highlight the layer you want to alter. Within that dialog box, find the Mode drop-down list and experiment with the different modes. For example, if you select Dissolve, the image will degrade as though its crispness has eroded.

Once you find the effect you like, play with the layer's Opacity setting. Use the Opacity slider bar to make the item more transparent. Then, click the Channels tab in the Layers, Channels & Paths dialog box. You will find that there are only three options: Red, Green, and Blue.

As with the layers before, you can click an eye icon next to the options to set the visibility to On or Off. For example, taking all the blue out of your image creates a striking change—unless there's too much blue in there already. Any changes you make here will apply to all of the layers.

Now let's turn our attention away from layers and toward The GIMP's other effects. We won't mention layers again, but feel free to experiment with the effects you apply to the layers in your image. Effects apply only to the top layer that you have visible.

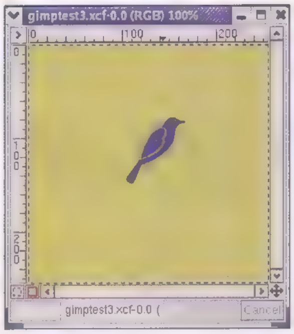


Figure 2: This image shows only the background and bird layers in place. Anything we do will only apply to the bird layer because it's the layer on top.

Now right-click your image. In the pop-up menu that appears, choose Filters. It's easy to spend hours here trying the various options, such as clicking Filters, Glass Effects, and Glass Tile. The layer that you apply this effect to will look like you threw it onto the ground and it shattered into pieces. Or, if you want to make the image look like a book page you are flipping, you can click Filters, Distorts, and Page Curl. Really take the image for a ride by clicking Filters, Artistic, and Cubism.

For more intense effects, explore the Script-Fu submenu in the main pop-up menu. Clicking Script-Fu, Alchemy, and Clothify can make your image look as if it's textured clothing. You can click Script-Fu, Render, and Lava to create a spectacular image that resembles peering into a volcano. Want to add a shadow beneath a particluar item? Click Script-Fu, Shadow, and Drop-Shadow.

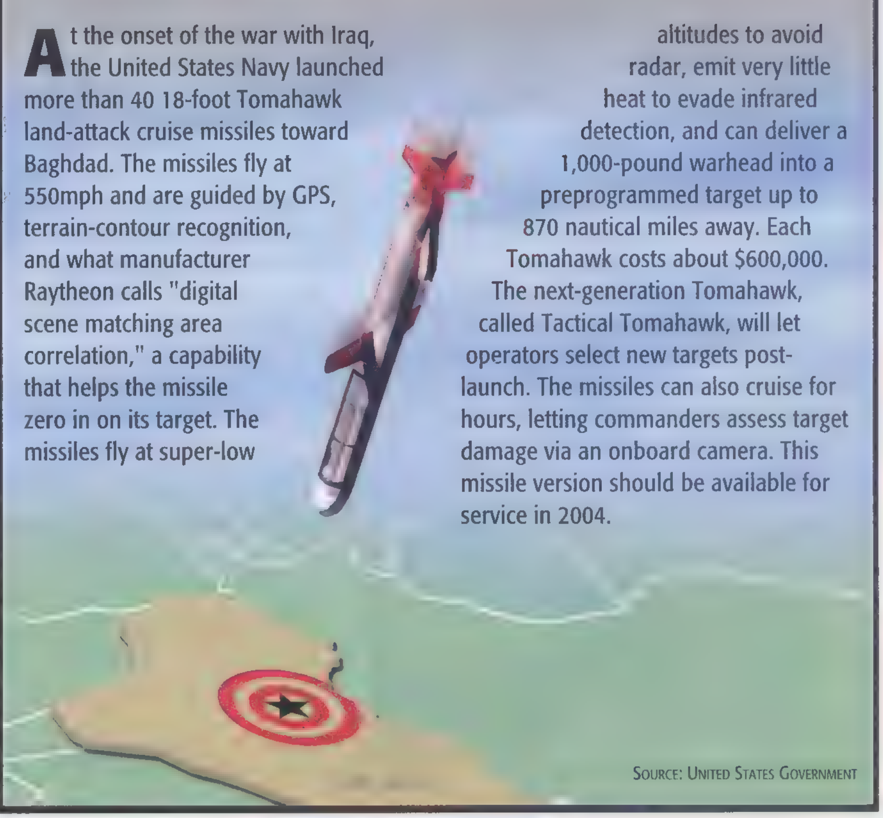
An Image Worth Keeping

You can create some truly hideous things with The GIMP if you go overboard playing with all the effects and layers that are available, but experimenting with the program is also a perfect way to get a feel for how The GIMP works. There are too many features in The GIMP to cover in a two-part article, but if you spend enough time experimenting, you're bound to find that you can make some wonderful graphics with this program. CPU

by Dee-Ann LeBlanc

Infinite Loop

Tomahawk Rock



At the onset of the war with Iraq, the United States Navy launched more than 40 18-foot Tomahawk land-attack cruise missiles toward Baghdad. The missiles fly at 550mph and are guided by GPS, terrain-contour recognition, and what manufacturer Raytheon calls "digital scene matching area correlation," a capability that helps the missile zero in on its target. The missiles fly at super-low altitudes to avoid radar, emit very little heat to evade infrared detection, and can deliver a 1,000-pound warhead into a preprogrammed target up to 870 nautical miles away. Each Tomahawk costs about $600,000.

The next-generation Tomahawk, called Tactical Tomahawk, will let operators select new targets post-launch. The missiles can also cruise for hours, letting commanders assess target damage via an onboard camera. This missile version should be available for service in 2004.

Source: United States Government

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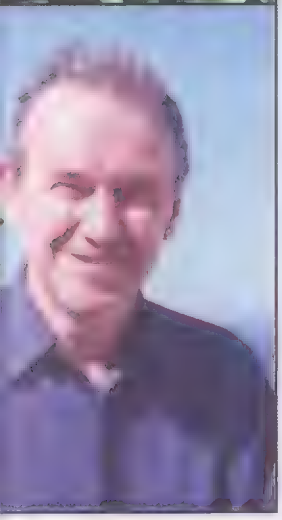
by Mike Magee

Wi-Fi Hotspot Shortage Wants Fixing Fast



Mike Magee is an industry veteran. He cut his teeth on ancient products like the Dragon and the Japanese PC platforms long before the IBM-PC won. He worked for a corporate reseller in the mid-'80s and saw the Compaq 386 sandwich box and every GUI known to humankind. Mike decided that the way to go was the Interweb around 1994 after editing PC mags in the late '80s and '90s. A co-founder of The Register, Mike started the chip-driven INQUIRER (www.theinquirer.net) in 2001. He has contacts from top to bottom in the business, spanning the entire chain, who help him root out interesting rumours and speculation.

Some of Intel's crazier claims about Wi-Fi technology need pre-bunking, but I think that the firm's doing a really great job promoting the wireless standard not only in word, but in deed, by spending money on the technology.

The crazy stuff concerns 3G and GPRS. Some Intel people believe that 3G and GPRS access will never come to pass because Wi-Fi will knock the stuffing out of the telco mobile Internet and people will use VoIP (Voice Over IP) and goodness knows what else when the hotspots are up and running.

What's not so crazy is Intel's idea that Wi-Fi networks could well be the dominant technology in 18 months' time everywhere other than Europe, where the telecommunication companies want a return on the billions of euros they paid to governments to get licences.

Take SFO (San Francisco International Airport) as an example; the airport is so close to Silicon Valley that you'd expect it to be very unwired, but the trouble is that while you can get Wi-Fi access, you have to be a member of the business and first class traveling elite—you know, those "platinum lounge" members. The last we heard, most people fall in the non-platinum lounge category, so this is hardly unwired access for the plebs.

And when Intel's Centrino comes to full fruition toward the end of this year, we still expect that most common people will be fiddling around with their "desknote" notebooks and the Pentium 4M. Intel, at least, has put its money where its mouth is. It has plunged millions of dollars of R&D money into developing the Centrino notebook platform. It has also put millions of valuable capital into firms that will further the Wi-Fi revolution. And it has pledged that by the end of the year there will be tens of thousands of hotspots worldwide, as a result of strategic relationships with third parties.

That is very much to be applauded. Of course, Intel has its own agenda to pursue—it can't make much money out of producing Wi-Fi cards or base stations. But on the other hand, the more successful 802.11b, 802.11a, and 802.11g become, the more silicon Intel will sell and the more the common weal is augmented.

Enabling technology does not necessarily mean you have to carry on making products as proof it works. Once you've proved a concept, you can allow others to get a share of the action. Later this year, Intel will move further into its plans to introduce Wi-Fi modules as part of desktop reference platforms as well. The advantages of this are obvious—you won't need to buy a base station to connect notebooks to a network. Its future plans even, rather ambitiously, suggest that radio frequency will be at the heart of every CPU it sells.

> **Later this year, Intel will move further into its plans to introduce Wi-Fi modules as part of desktop reference platforms as well.**

That's a significant challenge, even for Intel. Intel's competitors must be worried whether they have enough R&D bucks to compete with "radio-free Intel," as its chief technology officer Pat Gelsinger dubs the R&D project.

In the meantime, we're back in the real world. When Wi-Fi works, in my experience at least, it is startlingly good (for example, 802.11a access is fast and furious). Intel readily acknowledges that some problems, such as billing, need to be fixed without delay.

Because it is a multibillion-dollar corporation, Intel already has the clout to persuade governments that unwired access is a necessary and useful way to connect people and governments. The naysayers argue that security isn't as good as it might be, but that's fixable too. Having a radio infrastructure with an Internet fat pipe that lets you connect just about anywhere in the world is a real breakthrough. Let's hope it doesn't take too long to materialise, faced as it is with Luddite-like arguments. ■

Mike Magee is more connected than the Mob. Try him at Mike@cpumag.com

Technically Speaking

An Interview With Mark Thompson, Founder Of AnalogX

When discussing Mark Thompson and his AnalogX network of Web sites, where do you start? Thompson is a programmer who gives away impressive and useful software tools and information through the AnalogX site (www.analogx.com) and his other sites. He's also a musician, posting freeware for creating music alongside his songs. Thompson spoke recently about some of the challenges and rewards of creating, maintaining, and updating the popular network of Web sites.

by Kyle Schurman

CPU: The AnalogX Web site is so unique and interesting. What's your favorite aspect of the site, and what's your favorite piece of software on the site?

Thompson: My favorite aspect of the site is also the most challenging part of the site, and that's keeping up with what people want and interacting with them. I really enjoy hearing about how people use software I've written, especially if they use it in some unique way. I really can't pick a favorite program from the site because I like them all for different reasons. That being said, I usually get the biggest kick out of Scratch, my DJ sample scratcher. Some of the songs people make with it are wild, the most memorable being a song called "Dog Juice," where the only discernable lyrics I remember were, "Somebody get me a sandwich." How can anything top that?

CPU: Is the site today what you had in mind when you started this project, or did you expect it to grow in a different direction?

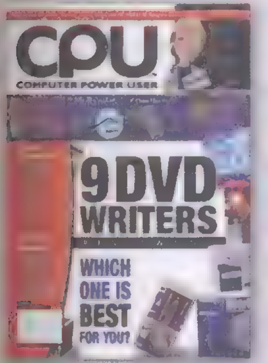
Thompson: I couldn't be any further from where I am today with AnalogX than when I began. The big turning point for me was when I was looking for a BPM (beats-per-minute) -to-millisecond converter to help make beat-synched tap delays. After scouring the 'Net, the best thing I could find was some bloated, 2MB shareware thing that would only allow the unpaid version to calculate odd tempos. I was a bit upset at the whole state of affairs, so I made a command line BPM calculator. I thought that if I wanted something like it, other people probably would as well, so I put it up on the site. Soon, I started getting people using it and emailing me about it, which caused me to make a Windows GUI on it and finally write an installer. People started suggesting other programs, I started writing more and more, and before I knew it, I had been releasing a program a week for more than a year.

CPU: I'm sure you hear from plenty of people who want you to commercialize the site or sell your software. How do you respond to that?

Thompson: I've got nothing against commercial software—I've spent most of my life writing it—but that's not what AnalogX is about. It's not meant to be the next Microsoft; it's not meant to say this is the right way or wrong way to do things. All it really represents is one possible way of doing things, and if you think it's cool, then it's possible for you to do the same or better.

CPU: How long have you been involved with music, and why did you start?

Thompson: I got into music when I got an Amiga; it was the first computer that could really do something better than a few beeps and clicks. I'm not really sure



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why I started writing music . . . beyond that, at the time, it sounded like something fun to do. Also, music and programming are more similar than most people would think. I've found that most of the really good programmers I've met are also either musicians or artists.

CPU: How long have you been involved in computer programming and what sparked your interest?

Thompson: I always loved video games and, like all kids, I wanted to make them. . . . Challenge has always been a big motivator for me, and there are few things I've encountered that are as challenging as programming. There is no clear right or wrong way to do things, and the only thing that limits you is your own imagination.

CPU: I read that you prefer programming in C to using C++. What's your reasoning behind using C?

Thompson: It's really nothing more than a preference. The last couple of programs I've written were actually done in C++. For the most part, I just feel more comfortable with C because it really forces you to think about your design and interface, or you'll quickly end up with something unmanageable. One thing people don't tend to get is that the language you use doesn't really matter. At the end of the day, all that really matters is the application you make with the language. I doubt most people ever give any thought as to whether a program was written using C#, Pascal, or Assembly; the bottom line for them is whether it does what they want or not. Now as a developer, I also have to keep design in mind because, at some point, that user is probably going to want version 2.0, and unless I want to rewrite the whole thing, I had better think about what I'm doing. Design is also language independent, though. I could take my same basic approach to programming and it would work whether it was PHP or VB, with some languages fitting better than others.

CPU: Who or what has influenced your programming the most?

Thompson: Two things have influenced me the most in programming and in evolving my particular style and approach over the years. The books that Microsoft Press has put out, such as "Code Complete," are the foundation for the way I program and view programming because they really tend to want to understand what works and doesn't work.

By far, the biggest influence for me as a programmer is my friend John Cumming, whom I've done contract work with for years. We would spend literally hours every day discussing different approaches, design methodologies, style guidelines, or anything else that helped us gain insight into what works in software development. It's one thing to say that you can do something better, but it's something completely different to say *how* you can do something better.

CPU: Where did the idea for the Web site come from? Where did the name "AnalogX" come from?

Thompson: I had decided to do a new band, and I had to decide if I was going to focus on making a good live show or if I was going to make a Web site. I figured that I could probably get a couple hundred people to come to a live show once a month or so, and I thought that I could probably get at least that many to a Web site, as well.

In deciding to do a Web site, I had a couple of rules about the name: It had to sound cool, it had to begin with the letter A so it would be at the beginning of an alphabetical list, it had to be easy to spell, it had to have no search engine matches, the domain name needed to be available, and it had to be less than eight characters. "Analog" starts with the letter A, and analog music gear is usually very desirable, so I thought it had the cool factor. Of course, "analog" has about 6 million hits on the search engines, so I needed something more unique. I didn't have many letters left to play with, so I thought I would use my favorite unknown variable, I. Unfortunately, "AnalogI" didn't really have a nice ring to it. But my third favorite unknown variable fit the bill, X, and—voila!—AnalogX was born.

CPU: How are some of your other projects progressing, such as PrePal? Why did you start that site?

Thompson: As a recovering gear junkie, I was constantly buying musical instruments off of places like eBay, but I always hated the fact that I was never sure if what I was getting was a good deal or not. Back in the day, there was a text file called the Used Gear Pricelist that tracked the prices that certain instruments sold for, so when you saw one, you could compare the price. The pricelist had stopped being updated several years before, and I wanted something that had accurate, up-to-the-minute prices, so I made PrePal and spent several months tuning the harvesting engine and adding different manufacturers and instruments to it.

PrePal then became the first site in what I like to call the AnalogX Network, which is a collection of sites that I developed but were of a scope that didn't make sense to be a part of AnalogX. A couple of the more notable other sites are Internet Traffic Report (www.internettrafficreport.com), Fixed Orbit (www.fixedorbit.com), and What Time Is It! (www.whattimeisit.com). The sites range from very technical to fun, but they're all meant to be very useful. The other driving ideal behind the AnalogX Network is that all of the other sites be updated on a regular basis via an automated mechanism, so I can spend time enhancing functionality instead of just maintaining the site. CPU

To read our entire interview with Mark Thompson, subscribers can go to
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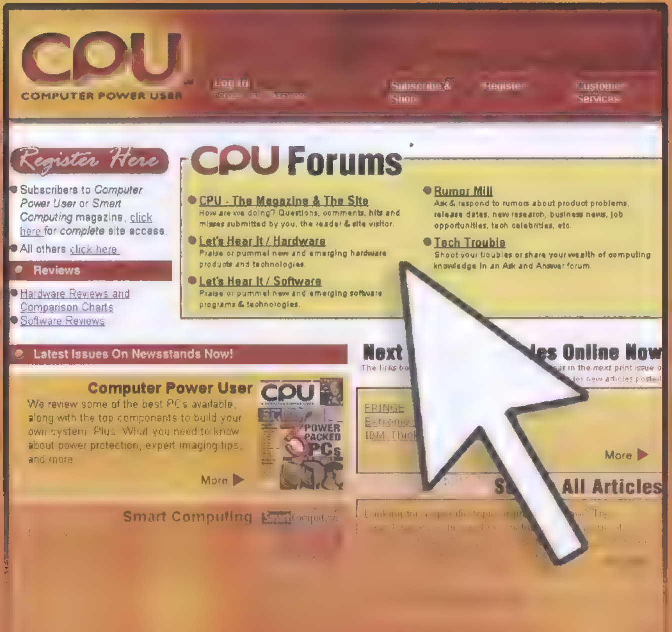

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Under Development

A Peek At What's Brewing In The Laboratory

The Rebirth Of eReaders?

Remember the RocketBook's attempt to bring on the ebook revolution? It was bulky, and its green background LCD and poor resolution made it a pain to read. Other designs had a similar lack of success.

Before the RocketBook, E Ink was founded in 1997 to design a better ebook technology. Electronic ink uses a TFT cell-addressing matrix, but instead of liquid-crystal cells, filters, and backlights, it uses cells filled with black and white pigments suspended in fluid. If a cell is addressed with two positive charges, the black pigments settle to the bottom and the white rise to the top. The effect is reversed with two negative charges. One positive and one negative charge shows white pigment on one side and black on the other, yielding a finer resolution for that cell. When display power is cut, the pigment orientations stay in place, so the image persists.

Peter Kurstjens, E Ink general manager of displays says, "The technology gives us very low power consumption. Once you put an image on the display, it will stay there for a very long time without consuming any power. Also, the display is much thinner . . . because we don't use a color filter, and we just use ambient lighting, which makes the display very cheap."

Despite 30 patents and a commercialization agreement with Philips, eink technology is still in the last phases of preparation for consumers. Kurstjens says eink is "performing close to something feasible for market launch." Consumer products expected by early 2004.

Will eink be better than previous ereaders? Most conventional displays operate at 72 or 92dpi. E Ink's displays sport roughly 160dpi resolution, but the perceived resolution is higher, Kurstjens says. The initial product generation will be black and white, but a move to 16-tone grayscale will happen in 2005. Philips and E Ink have the technology to go to 256-tone, and color displays have been demonstrated, but the companies doubt the market needs more than 4-bit grayscale short term.

Digital paper is nearly here. Electronic Ink has the technology and Philips has the TFT display.

Expect ereaders in stylus- and button-based versions and eventually flexible displays. "eink is a flexible material," says Kurstjens. "If you bend it, you don't see any optical distortion. Of course, if you do that to an LCD display, you would see all kinds of optical effects. Kurstjens says replacing the current backplane with a flexible backplane to create a flexible display is "on our road map for years to come." ▲

When Blurry Is Crystal Clear

Anyone who has peeked through a pair of night vision binoculars knows the human eye has obvious limitations: We can't see heat or infrared or X-ray radiation, at least not without some technological assistance.

We also struggle with depth of field. Pick up any camera with manual controls, and you'll find that the lens' aperture, like a human eye's iris, controls depth of field perception. But there are times when you don't want depth-of-field limitations. For example, in looking down a suburban street on an overcast day, you may want the mailbox beside you to be in the same perfect focus as the mailbox 50 feet away. In many cases with conventional optics, this would be impossible.

In the 1990s, Edward Dowski Jr. and W. Thomas Cathey, both of the University of Colorado at Boulder, hit upon a saddle-shaped lens design that does the opposite of the human eye. Rather than use a convex shape to keep the entire field of view in focus, the lens was specifically designed not to focus on any focal plane. Moreover, the entire image is uniformly blurred as it's projected onto a digital sensor. Dowski and Cathey refer to this process as "encoding." The blurred image is then fed through a digital-processing algorithm that "decodes" the data into a sharp, focused image that can achieve a depth of field 10 times that of traditional optics, the inventors say. The only downside to the technology, dubbed Wavefront Coding, is that the decoding process generates a fair amount of noise, but this is also cleaned up in post-processing filters.

Dowski and Cathey helped found CDM Optics to develop and market their invention. Most sales have been to clients such as Olympus Optical and Carl Zeiss for use in medical and scientific equipment. However, because there are no moving parts in the lens, Wavefront Coding could prove extremely inexpensive to implement in conventional point-and-shoot digital cameras, not to mention that the technology can help correct the chromatic aberration (separation of the red, green, and blue color channels) that plagues many lenses. ▲

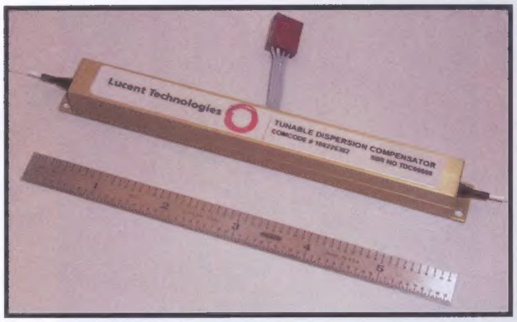
by William Van Winkle

Bell Helps Boost Backbone To 40Gbps

The fastest Internet backbone speeds today reach about 10Gbps. This is still 10,000 times faster than a 1Mbps cable modem connection can achieve, but the rise of streaming media and other bandwidth-hungry data services may soon bog down traffic globally. The trick is finding a way to upgrade data-line bandwidth without replacing the entire fiber optic infrastructure.

Within a fiber optic cable, transmitted light pulses are polarized. When traveling over long distances, different polarizations tend to move at different speeds, causing a pulse to elongate and become less distinct. Eventually, a pulse becomes unreadable.

Enter TDC (tunable dispersion compensation), a technology John A. Rogers and his Lucent Technologies' Bell Labs colleagues recently unveiled. A TDC device places a thin film of liquid crystal between two gold electrodes that sit between two optical fibers butted end to end. Just as liquid crystal in TFT panels can bend light to achieve certain optical effects, liquid crystal in a TDC device can alter a light pulse's polarization. Once the polarization is corrected, the pulses can be recompressed and continue their journey.



This tunable dispersion compensator, developed at Lucent's Bell Labs and now sold by Furukawa, helps clean up signal distortion in fiber optic cables. If successful in the market, it may also help quadruple the Internet's backbone speeds.

"This type of functionality—i.e. tunable dispersion compensation—is a requirement for any system that has 40Gbps channel speeds," says Rogers. "These 40G systems are lower in cost, on a per-bit basis, than 10G systems. We believe that our tunable dispersion compensation is the most cost effective solution for enabling 40G systems. The innovation is scalable. We have published papers and given talks that demonstrate its successful use in realistic systems testbeds with single-channel speeds up to 160Gbps. For certain technical reasons, our approach actually gets simpler at higher data rates."

Lucent's technology has already entered commercial products but hasn't dented the Internet's infrastructure, yet. However, with TDC's unexpected cost-effectiveness, hopefully more backbone breathing room won't be far away. ▲

Archimedes Puts Intentions Into Action

Perhaps you've stumbled across the Accessibility Options in Windows, which let you do such things as zoom in on wherever your mouse is pointing (for the vision impaired). Many users have never heard of these features, and generally, computing solutions for the disabled are rare and expensive.

That's why Neil Scott, leader of the Archimedes Project at Stanford's Center for the Study of Language and Information, started developing new ways for the disabled to interact with computers in 1992. The goal is to try to make accessibility technology as transparent as possible so people, regardless of abilities, preferences, and culture, can manipulate information.

However, Scott became disillusioned in 2002 with the never-ending need for research funding and the marketplace's lack of enthusiasm for accessibility products. He was still being approached, however, by regular consumers, particularly gamers and PC enthusiasts, interested in his group's products and technologies, most of which could potentially enable more interesting or efficient means of controlling apps than are now available.

"For example," says Scott, "a lot of AI and natural language processing gets complicated because it's unbounded, that out of all the myriad things that could go on, what is the most likely right now? We're taking the approach that if I'm standing in front of the TV, and I'm looking and talking at it, I'm probably giving commands to the TV. Thus if the system hears something relevant to the TV, it will go ahead and do it."

Regardless of hardware or platform, the technologies Neil Scott and his group at Stanford's Archimedes Project are developing will help the disabled interact more easily with computers and may even be used in a new wave of gaming peripherals.

The Archimedes Project's effort has generally been aimed at the K-to-12 market, but Scott admits the group is negotiating with "a prominent peripherals vendor in California" to develop a line of products that would carry over directly into the PC and game console markets. With the use of an external controller hub that's agnostic to apps, devices, and OSes, users simply join the hub to their platform and start adding whatever peripherals make sense for their needs.

"We now have the technology to attach all kinds of devices wirelessly to consoles in place of the controller," he says. "At the moment, we have [several] peripherals: large vocabulary speech, small vocabulary speech, gyroscopic head tracking, a gyroscopic motion detector that can be used on any part of the body, video motion detector, and Morse code touch scanning." ▲

Q&A With Andy Paul

Andy Paul, CEO and president of Corsair Memory, has helped guide his company to a leading position in memory module manufacturing. Analysts widely consider Corsair to be the leading manufacturer of high-quality, high-performance memory and of overclocking memory technology for the enthusiast market. Paul has worked in the high-tech industry for almost 25 years and co-founded Corsair in 1994.

Q Corsair is known as a leader in creating high-quality, fast memory products. Has that always been the focus?

Paul: Actually, we didn't start doing DRAMs at all; we started the company to make L2 cache modules. That sort of suddenly emerged as a new thing in about 1993. The founders and I knew how to make them because we had been working at a memory company before that. The existing memory module companies at the time were making slow DRAM, so there was little expertise out there to make synchronous modules. That's how we started. Of course, a couple of years later, Intel incorporated the entire cache function on the processor, so that market went obsolete. Then we moved on to make server memory. Then, finally from there, we started to make DRAM modules for the masses when they started becoming synchronous. The consumer market now, that's 80% of our market. The reason we didn't start [with the consumer market] was because only now do consumers have the need for fast DRAM. When we started the company, there was no differentiation; it was all EDO and Fast Page Mode.

Q What are some of the challenges Corsair faces in developing new products? Is it hard to provide impressive products at a competitive price?

Paul: A little bit. These days, the tricky thing is to figure out a product's relevance in the market and also find out what customers really want. So much of our market, the memory module market, is—well, not really smoke and mirrors—but a lot of people are somewhat misrepresenting of the products they have. The last round of products we launched was low latency. We spent quite a long time there trying to figure out whether we should lower the latency or increase the speed. It really is a bit of a balance. We elected eventually rather than to stretch out the speed—because the option was to take our 3500 part and extend it out to 3700 or 3800 or to lower the latency—we finally decided to lower the latency. That was clearly the right thing to do because that ended up being the most successful product we've had.

Q What can enthusiasts expect from both memory and the PC industry in the next five to 10 years?

Paul: It's an interesting question, because you have to sort of go back 10 years to get that in perspective, right? Ten years ago, computers were just moving to 33MHz, and synchronous memory didn't even exist in DRAM. If you'd have asked me this question, or anybody this question, 10 years ago, no one would be predicting 3GHz CPUs and 500MHz memory buses. It's really tough to tell with memory more than a couple of years [in the future]. We know it's going to get bigger and faster, that's for sure. I think in terms of PCs, you can see that those changes are happening now, and that's really about format. What's happening now is that PC as a name is something that's been with us for 25 years, and it's probably not that relevant. I think we have to start thinking: What device do you do what with? Certainly, what I see now going on is like in my own life. I see all of these different things I have—laptops, PDAs, cell phones—they're all starting to merge into one thing. All are becoming wireless, [with] Bluetooth and infrared. Already the phone I bought two weeks ago has as much functionality as the Palm PDA I bought last year. I think we're going to see very different devices floating around: one format for something you sit at home and play games on, a different device that you travel around with, and perhaps a different device that you have on your desk to do work with. I think that's the way that's heading.

Q What's one thing you'd like to change about the industry?

Paul: The overall industry, the way it is right now, is pretty good for us. We've been gaining market share. I wouldn't want to change that. I think I'd like to change the traffic in Silicon Valley, cut my commute time down.

Q That could be the most challenging task you've ever faced.

Paul: [Laughing] Right.

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Kyle Schurman has been writing about computers and the computing industry for* Smart Computing *and* CPU *magazines for nearly 10 years.

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